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VIEWS, NEWS AND INTERVIEWS.

John Delfino, a murderer, was electrocuted at the Sing Sing, N. Y., prison, on December 4. The current of 1,760 measured volts and six and one-half amperes was shot into Delfino's body at full strength for four seconds, and then was reduced to 160 volts, at which it was kept for 46 more seconds, when it was shut off. From under the cap that was fitted to the man's skull there came a slight whiff of steam when the current was turned on and passed through the dampened sponge, but aside from this and the stiffening of the man's body against the straps that held him by the head, body, hands and feet to the chair, it is said that there was no sign of violence in the execution.

A German technical journal is authority for the statement that electrical etching has advantages over the usual methods in that the solution need not be nearly as strong, and that when seen under the microscope the etched lines and edges produced by intersections are quite even and clean cut, while in the usual method they are rough, due probably to the gas bubbles formed, and the lines are apt to be rough, the metal being eaten away below them; the disadvantages are that the current used requires to be regulated, and that the solution must not be too strong. A detailed description is given of how the electrical method is used. Among other things, it states that it is better to use a solution of the salt of the metal of which the plate is made in preference to an acid bath. A good covering material is made of equal parts of asphalt and copal varnish.

The experiment of operating boats by electricity on the Erie canal does not seem to meet with approbation. Recently it was discovered that the wires strung for the purpose had been cut in several places and poles felled. It is supposed that the damage was done by the drivers, whose occupation in the tow path will be gone if the electric motors prove successful. New machinery seems to be constantly more and more driving unskilled labor to the wall.

An amusing incident occurred on the "Nictheroy," one evening shortly before she sailed. Captain Zalinski spent the night on board and about 11 o'clock determined to try the pneumatic gun with a blank charge, which in this case is compressed air. The seamen were asleep, and when the gun was fired the concussion brought the men out of their hammocks in quick order. Some one of them yelled that dynamite had exploded. There was a wild rush for the deck ladders, and the petty officers could not control the thoroughly frightened crew for quite a time. Finally, Third Officer Sparling, one of our electrical brethren, jumped down among them, ordered every man to his hammock and by his determined coolness quieted the confusion. The episode does not show that much discipline prevailed at the time on the Yankee notion war ship.

Mr. Frank De Haas Robinson, of Cleveland, O., is a very liberal man. Some time ago the Little Consolidated Street Railway Company, of which he is one of the heaviest stockholders, offered $100 to all conductors who served the company a year without accident. Upon Mr. Robinson's return from New York recently he learned that 15 conductors had been discharged on account of the dull times, eight of whom were entitled to $100. Each of these men received the reward with the statement from Mr. Robinson:

"I give up the $800 because you have earned it. If the stockholders do not approve of my action my purse can stand it."

Professor Fritch, lecturing in the Museum of Ethnology, at Berlin, to 200 military officers, said that with the aid of electricity he had been able to photograph projectiles in transit. He exhibited photographs showing the air waves caused by the missiles, which form a legible record of the velocity with which they had traveled. The apparatus used by the Professor is said to be the invention of Vernon, of Edinburgh, Scotland.

West Springfield, Mass., is having a little boom in residence lighting.

More Electric Canal Boats.

It is reported that electric power will be tried on the Chesapeake and Ohio Canal, and a company has been organized at Baltimore, Md., to further the project.

Preparations are also being made for a trial of electric power on the Miami Canal at Chillicothe, O.

Life Fenders For Brooklyn, N. Y., Trolley Cars.

The Brooklyn City Railroad Company has decided to introduce on the trolley cars the life-saving fender invented by Louis Pfingst, which has been for some time in use in Boston and other cities. The contract calls for 1,000 fenders, which will equip 500 cars. The cost is about $35 for each car, or a total of $17,500.

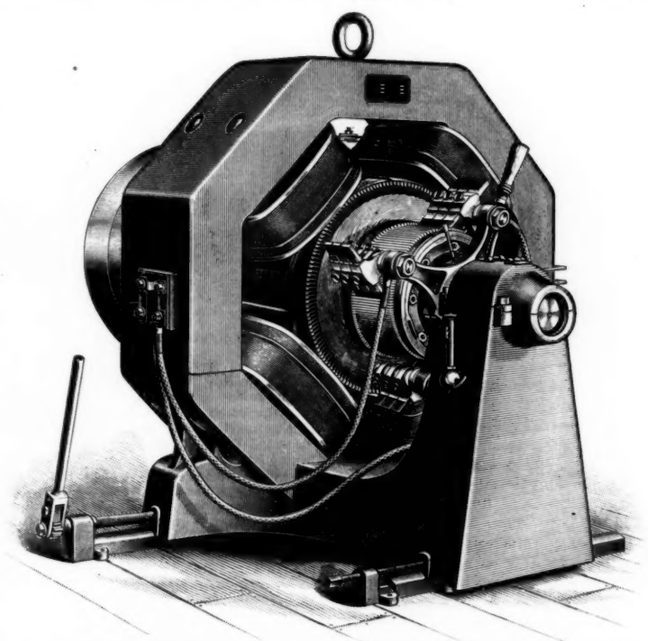


FIG. 1.—EDDY COMPOUND WOUND DIRECT-CURRENT GENERATOR.—(See page 196.)

New Orleans Electrical Society.

A movement toward the formation of an electrical society in New Orleans, La., is receiving hearty support. The initiation fee will probably be five dollars and the dues one dollar a month. It is expected that headquarters will be secured in a central location, and that club features will be added in the course of time. Facilities for experimental work will be provided and meetings will be held at least twice a month. The most prominent electrical people of the city are working hard to perfect the organization.

ON A BOSTON PLATFORM.

Some Phases of Life as Seen from the Front Platform of an Electric Car in the Hub.

THE WEIGHTY OPINIONS AND GOOD COMMON SENSE OF A FUR-COATED GIANT—HOW HE STOPPED A CAR IN ITS OWN LENGTH AND DAMAGED HIS STOMACH AND THE DASHBOARD—THE ADVANTAGES OF A SAND BOX WHERE THERE ARE HEAVY GRADES—DANGEROUS PATH FOR CLAIRVOYANTS—"KEEP A SHARP LOOKOUT AHEAD AND DON'T GET RATTLED"—SOME OF THE HUMORS OF THE REAR PLATFORM.

Much has been said and written about the "deadly trolley," and the dangers of this so-called "modern juggernaut" have been expatiated upon times without number, for the edification, or otherwise, of the traveling public. As there are always two sides to a question, and it is but fair that both should have a hearing, perhaps a few words as to the operation of these much abused "electrics" and the men who handle them, might not be out of place.

That heavy cars, such as are now coming into universal use, driven by the vast power of electricity, and carrying with them a momentum not readily to be overcome, might prove a dangerous element in our public streets if intrusted to incompetent hands, there can be no doubt, but to anyone who will take the trouble to look into the matter carefully it will soon be demonstrated that no charge of incompetency can be brought against the average motorman, and, indeed, it will be found that he is remarkably well posted as to the duties he must perform, and has acquired an astonishing amount of skill in handling his car.

Nowhere is there a greater necessity for fine work on the part of the motorman than on the West End system of Boston, where the great number of cars from all sections of the suburbs concentrate in two of the narrow and densely crowded streets of the business portion of the city, and where a pedestrian can at any hour of the day see a double row of cars closely packed together extending in either direction as far as the eye can reach.

A few hours spent on the front platform of any of these cars will convince the most

skeptical that the motorman knows his business and has his car under wonderful control. I have ridden and talked with many of them, and must say I have found them a remarkably intelligent body of men, ready for the most part to talk on any subject, from political economy to the latest style of brake, and showing a pretty clear idea of the merits of both. Anyone who imagines the motorman of the present has no ideas outside of switching on and off the current and twisting a brake handle, is very much mistaken. During the early part of last Summer, while the operation of electrically welding the joints of the rails was being carried on over a portion of the Cambridge line, I had occasion to visit the spot, and watched the work under way with considerable interest. On my way back to town I took occasion to sound the motorman as to what he thought of the scheme, and whether he found his car ran any more smoothly over the section on which the work had been completed. He discussed the merits and demerits of the work freely and intelligently, and showed not only a thorough knowledge of the manner in which the work was done, but also the purposes for which it was undertaken.

I ran across a genial old giant in a fur coat the other day on one of the cross-town cars, and, after a little preliminary sparring, endeavored to get his opinion of the brakes with which his car, which was one of the large eight wheelers, was equipped. He expressed himself as being well satisfied with the style and power of the brake when properly adjusted, but said that the adjustment was not always as well looked after as it might be. Said he: 'The trouble lies with them fellows who are supposed to look after the cars and see that the brake shoes are properly adjusted and the chains regulated, so that an even pressure is thrown onto all the wheels at the same time. With a good rail and proper adjustment, I don't want anything better than this brake, but the chumps don't know how to take care of it. Half the time some of the wheels are turning, while the others are sliding, and, of course, it makes it harder to stop."

When asked whether he could stop his car within its own length while running at the average speed of about 10 miles an hour, he said "Yes, I could, but not with the brake."

"How then?"

"Why, by reversing my current. I never had to do it but once, and I don't want to do it again. You see it was this way. I was going up Huntington avenue late one afternoon about a year ago. It was getting on towards dusk, and I was bouncing along at a fair speed with about half power on, and just as my forward wheels struck the down-town crossing I saw a carriage come tearing out of the side street, and it didn't take much thinking to convince me that one or the other of us had got to stop, and mighty sudden, too, or something would break. I didn't have time to see what the other fellow was going to do, and I didn't bother with the brake, either. I jammed that switch over with one hand and opened her wide with the other. Stop! well, I rather think she did. I had an idea I'd stopped myself for a minute, for I doubled up over the dashboard so hard I had stomach-ache for a week. The conductor came half way through the rear window, and I reckon it took the passengers some time to find out where they were at. She stopped, sure, and the carriage got by all right, but for general use give me the regular brake."

After a hearty laugh at the comical expression of misery the remembrance of that sudden stoppage brought to his grizzled countenance, I asked whether he was fairly well satisfied with his work and the treatment accorded him by the company.

"Oh, yes," said he, "I don't find any fault. They treat us pretty well, we have stead work, fair pay and regular hours, and while we ain't any of us getting rich, we manage to make a living, and that's something these days."

As I was pretty well out towards the suburbs by this time, I bid my philosophic friend good day and boarded a car going in the opposite direction.

The boss of the front platform in this instance was a man about half the size of my previous acquaintance, but evidently a veteran, and one of those cool wiry little fellows who make up in nerve what they lack in size. The car he was handling was another of the large ones, though the trucks were of a different pattern, having six wheels instead of eight, and consequently a less number of brakes. A practical illustration of the difficulty found in stopping these cars when the brakes are not properly adjusted and the wheels slip, was furnished me just after boarding the car and when we had slowly started on a steep down grade.

A party of three came hurrying after the car, and the motor man catching sight of them applied his brakes sharply, and as the car slackened speed but continued to slide along the rails, crowded them down to the utmost. In spite of all he could do the wheels continued to slide until he reached over the dashboard and sprinkled some sand on the rails ahead. As soon as the wheels reached this they held at once and the car stopped with a jerk. I suggested that a sand box immediately in front of the wheels which could be operated by a lever or by his foot would be an improvement.

He agreed with me in this and said such an apparatus had been invented and tried successfully, but that the company had refused to put them on, like a number of other good things, because it required a considerable outlay of money.

In the course of conversation he told me that he had spent twenty years on a front platform, and had handled almost everything in the way of motive power, from a single mule to electricity. He had been very fortunate in escaping serious accidents and had had only one close call to running over any one, and this had occurred when he was driving a horse car in East Boston some 15 years ago. I was naturally interested in hearing the particulars, and he was ready enough to tell the story.

"It was one sharp, frosty morning in the early Winter," said he, "and I was driving four as fine high stepping bays as ever I held a line over. It was on the last half of my first trip and there was just enough snow on the rails to make them slippery, and as the horses were feeling good and pulling hard on the bits, it was no easy matter to brake up. A woman came out of a house about a hundred yards ahead of me and started to cross the street. When she struck the track she evidently liked the looks of it, for instead of crossing the street she started walking along between the rails in the same direction I was going.

"I knew her by sight as a sort of a clairvoyant, and I guess she must have been in one of her trances and hadn't got fully waked up, for I shouted to her three or four times, but she didn't seem to hear me and walked along as cool as you please. I saw I would have to knock her over, and the question was how I could do it with the least damage to her. I had the brake down as hard as I could get it, so I dropped that and took both hands to my horses. I put my whole weight onto the lines, talking to them all the time, and just before the leaders reached the woman I spread them apart as far as possible. The crossed lines between the leaders heads hit her on the back of the neck and over she went. The horses passed on each side without stepping on her, and as the brakes began to hold, by that time the car stopped just as she was going under the platform. I had the horses off the car in about a second, and two fellows who were outside with me jumped off and hauled her out. She wasn't hurt a bit, and after pulling herself together a little walked off about her business. Was I rattled? Well, no. I was too busy to get rattled until it was all over, and then I only felt a little shaky in the knees."

When asked which he preferred to handle, a horse car or an electric, he said "the electric every time."

Being still curious I asked if he ever got confused in twisting the two handles when he had to work both quickly.

"No, I never have any trouble that way," he replied. "I've done it so often and for such a long time that it gets to be a sort of instinct with me, and my hands almost work themselves. I run my car by the feel of the brakes, and know pretty well what I can do with her. I always keep a sharp look out ahead, and if a man does that and don't get rattled easily he's all right."

These sentiments embody the expressions of nine out of ten of the men with whom I have talked, and may well be taken as a criterion of the whole class.

While the front platform is by far the most interesting spot on which to ride, the humorous side of life is more often to be seen from the other end. I witnessed a rather amusing incident from the back platform of a crowded Washington street car one snowy evening last Winter. A little woman bundled to the ears in a fur coat stood on the corner of the street, and as the car on which I was riding came along, signaled for it to stop. The particular corner on which she stood happened to be unmarked by a white post, and consequently the car was not allowed to stop there. Serenely unconscious of this fact she hurried out into the street and waded through the slush for half a block until another car ahead compelled it to come to a standstill, when she boarded it with blood in her eye and an evident desire to annihilate the conductor.

She was rather a stranger to the mysteries of Boston's rules for rapid transit, and after receiving the conductor's mild explanation with an incredulous toss of the head, stepped inside the car and nursed her indignation in silence. The quiet smile which spread over the countenances of the passengers within sound of her spirited rebuke did not tend to smooth her ruffled plumage, and when the car reached Elliott street and the conductor, who was up forward collecting fares, sang out to change for the Boston and Albany depot, she squeezed her way through the crowd in a frantic effort to alight. Just as she reached the platform the car started again, and as no one offered to stop it she seized the first rope which came to hand and pulled it vigorously. The lights went out, the car stopped, and the little lady stepped off in triumph, having the satisfaction of knowing that this time, at least, the car had stopped at her bidding. She had pulled the trolley off the wire.

H. G. TUCKERMAN.

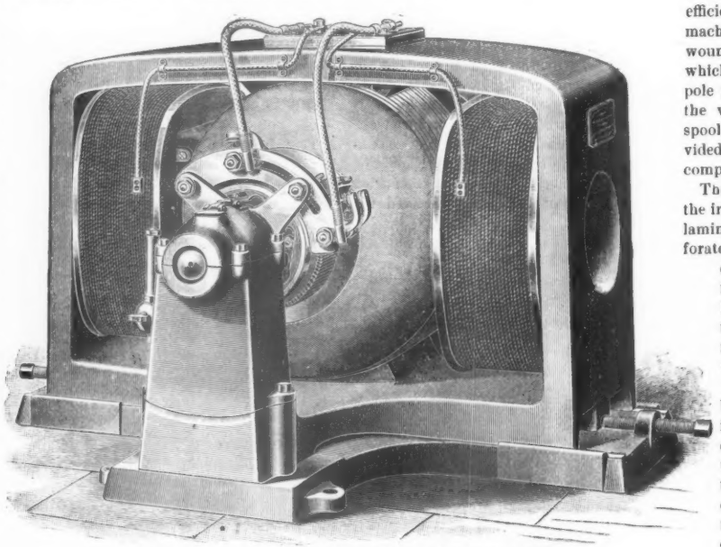


FIG. 2.—TYPE "H" EDDY SLOW SPEED STATIONARY MOTOR.

New Apparatus of the Eddy Electric Manufacturing Company.

The Eddy Electric Manufacturing Company, of Windsor, Conn., has just put upon the market a type of electric generator, which has many novel points of excellence to recommend it to those who use and have charge of such machines. The illustration, Fig. 1, gives a clear idea of the general appearance of one of these dynamos. These machines are built in capacities varying from 52 kilowatts to 360 kilowatts, either for power or lighting purposes, and as throughout the machine every care has been taken to insulate against the tension of 500 volts, it may be seen how thoroughly they are protected against strains of lower pressures.

The magnet is of the four pole iron-clad type, with frame of cast-iron, to which are bolted pole pieces of soft cast-steel. The high permeability of these pole pieces permits of a comparatively small section of metal on which the exciting coils are to be placed, and by thus diminishing the length of a turn of wire, reduce the lost energy of excitation in a great degree. The pole pieces again have extensions on the armature end by which the cross-section of the air gap is increased, and as the length of this air gap is small, owing to the adoption of an iron-clad armature, the energy necessary for exciting the fields is greatly reduced. Special emphasis is laid on this point in order to explain in part the exceedingly high efficiency and low temperatures which these machines attain. The exciting coils are wound on carefully insulated metal spools, which are supported away from the encircled pole piece, allowing free access of air for the ventilation of the inner surface of the spools. Separate compartments are provided for the series and shunt coils of the compound winding.

The armature, as mentioned above, is of the iron-clad type. The core is made up of laminated charcoal iron, mounted on a perforated barrel. The barrel has apertures at either end through which air is drawn, flowing out by the action of centrifugal force through ducts left among the laminations of the core. By this means a thorough ventilation of the whole armature is secured.

The conductors consist of copper bars of rectangular section embedded in grooves cut on the surface of the core. They are carefully insulated by tubes of paper and mica, a double thickness being placed between bars of opposite potential. Connections are made at either end by means of flat copper ribbons so bent and arranged that at no point are strips of opposite potential in close proximity. This last is a feature of great importance, as it is among the end connection of an armature that nine-tenths of the "burn-outs" occur. All the copper used is of ample section, wasting little energy in heat. It will be seen that such a construction, while eliminating the danger of accidents as much as possible, also permits easy repairs should one occur.

The thought expended in the design of this type has been especially shown in the construction of the commutator. Here the aim has been to simplify the parts by which the segments are clamped, and at the same time to give as great strength and solidity as is consistent with ample insulation. All metal has been removed from directly beneath the bars themselves so that the air is allowed free flow. Collars and heads, clamping the segments at either end, are bolted together, and these bolts are prevented from jarring loose by a simple but efficient nut lock. Thus, should the bars at any time work loose, a turn of a wrench on a nut will remedy the trouble without removal of the armature from the field.

The brush holders are of the "end contact" type, pressing carbon brushes radially against the surface of the commutator with a variable tension. They are supported by studs projecting from a rocker arm, and may be adjusted to the neutral point without trouble or danger to the attendant. These studs will allow the use of the tangent brush

holders also, which are preferred by many station managers, and the machine in the illustration is so equipped.

The mechanical features of the machine are as excellent as are the electrical. The armature is well balanced and turns on a ground shaft without noise or vibration. The bearings are of the self-aligning, universal adjustment type, with oil rings turning on the shaft and carrying the lubricant from a reservoir below. The whole machine is mounted on tracks, on which it may be moved for tightening the belt by means of a ratchet lever.

The entire finish of the machine is of the highest grade, and its performance almost perfect. It is entirely automatic in its regulation, even to the brushes, which show no sparking and require no change of position for the most extreme variations of load.

During a recent test of a dynamo of this type, generating 110 kilowatts at 600 revolutions per minute at a weight of 10,000 pounds, it is reported that the machine was operated for 10 consecutive hours at full load, without exceeding a temperature of 60 degrees above the atmosphere of the room. At the end of the test careful measurements showed a commercial efficiency of 95½ per cent. Such results as this have seldom been attained by dynamos of equal speed and weight, and the Eddy Company should be congratulated on its achievement.

Another type of apparatus recently developed by the Eddy Company is a motor of

THE ROBINS LIFE GUARD FOR ELECTRIC CARS.

new design to be known as type "H." It has been produced in response to a demand for a motor running at a lower speed than the well-known type "C" Eddy motor. In this machine it has been the aim to produce a motor of low speed and light weight, and which at the same should be of the highest efficiency. Its simplicity and fewness of parts render more than a brief description unnecessary. The field magnet is of the four pole type, excited by two coils, which are wound on easily detachable metal spools. It is constructed of a fine grade of soft cast-steel, and its general shape as shown in the cut shows great rigidity and lightness. The polar extensions under the exciting coils are hollow, which serve to increase the radiating surface of these coils, and also affords a channel for the air to leave the armature. The bearings are self-oiling and self-aligning and are furnished with oil guages.

The armature core is thoroughly laminated, and in the larger sizes ventilated by air ducts. The conductors, well insulated with mica and silk, are embedded below the surface. This construction not only protects the wire from mechanical injury, but at the same time secures a maximum magnetic field with minimum exciting power.

After being wound the coils are saturated with a water-proof varnish, which thoroughly protects them from attacks of moisture. The commutator is of special design, and is ventilated like the core and fields. The segments are perfectly insulated and held in place between collars, in turn secured by bolts and nuts. The whole is very strong, simple and readily accessible. The machine runs cool and sparkless, and, with its close speed regulation and high finish, is in perfect keeping with all the products of this company.

The Robins Life Guard for Electric Cars.

Owing to the liability of accidents to human life, due to the high speed of electric cars required by the demand for rapid transit, a satisfactory and practical life guard for electric cars has become a necessity. The Robins Life Guard and Manufacturing Company, 60 Manhattan Building, Philadelphia, has recently placed upon the market a device which seems to fulfill all the requirements. Tests have been made on several railroads, with cars running at from two to 15 miles an hour, and between 250 and 300 adults and children have been picked up without suffering the slightest injury. The illustration herewith shows how a man was picked up in Brooklyn, N. Y., on October 10, 1893, when the car was running 12 miles per hour. A general description of the Robins life guard is as follows:

The fender consists of an iron frame, bolted to the under part of the car body and extending in front of the car three feet and six inches. The frame is made of one inch gas pipe, hinged in such a manner that it can be folded up when the car is reversed, or for storage purposes, occupying a space of only 10 inches.

Wire netting covers the bottom and extends upwards at a right angle and in front of the car platform, being about six inches from the dashboard, the horizontal portion of the netting and frame being six inches from the track or roadway. The wire netting is attached to the frame by springs, thus preventing a person caught up in the fender from receiving any undue shock or injury.

Across the front end of the fender there is an elastic steel frame covered with a rubber tube five inches in diameter. This frame and tube is connected to the ends of the fender frame by two short springs, making a very elastic buffer; and as this buffer is what a person standing on the track would first come in contact with, owing to its yielding nature and to the fact that there is nothing solid across the front end of the fender (the end of the frame being practically open, as the cross-bar is placed back eight inches from the outer end), the blow struck is a cushioned one.

There is also a second rubber guard, 10 inches high, attached to the bottom netting, eight inches from the front end of the fender. This guard has a spring-controlled rearward movement, and, when in position, stands upright. Its object is to prevent a person from being thrown out of the fender after having been caught up. The horizontal portion of the fender can be easily and quickly transferred from one end of the car to the other, the actual time required being but one minute. This will greatly reduce the cost of equipping cars that run in both directions.

The Novak Case.

In the United States Circuit Court at Hartford, Conn., on December 9, before Judge Shipman, a hearing was had in the case of the Edison Electric Light Company against the Waring Electric Company of Manchester, Conn. The plaintiffs pray that the court issue a permanent injunction enjoining the defendants from manufacturing the Novak lamp. Fish, Dyer and Seward, of New York, appeared for the plaintiffs, and ex-Commissioner of Patents W. E. Simonds and Buck and Eggleston for the defense.

The Edison Electric Illuminating Company, of New York, which has been requested to extend its subways into Central Park, has announced its inability to make such extension at present, and the lighting of the Park drives by electricity will be indefinitely postponed unless provision is made for the putting in of a lighting plant of its own by the department.

A New System of Lighting and Extinguishing Street Gas Lamps Without the Use of Wires.

An electrical system which operates at will from a central point, devices placed miles apart with no electrical connection between them, sounds like a fairy tale, but is, in fact, not only possible, but commercially practical. The Cutler system discards both the overhead wires and the underground circuit, and adopts an entirely new and inexpensive method. Each lamp is supplied with two sal ammoniac batteries and a spark coil placed in an iron box buried in the ground at the foot of the post. In the lantern is a miniature gas holder of about two cubic inches capacity, pivoted on a hinge and held down by weights; and directly over this holder is an automatic gas lighter, similar to those used in houses, only much simpler, larger and stronger. Two wires about 10 feet long connect the lighter with the batteries through the post. Such an installation is under complete control from the gas works. When it is desired to light the lamps of a city it is only necessary to open a valve connecting one of the large gas holders at the works, direct with the gas mains. This results in a decided increase of pressure in the gas all over the city, sufficient to cause all the little gas holders in the lamp posts to lift up about one-eighth of an inch against a platinum stop, and thus close the local battery circuit at each post. The automatic lighter being then supplied with current, immediately turns on and lights the gas. In a word, the system is merely a huge pneumatic push button, and corresponds precisely to pushing a button when desiring to

FIG. 1.—ELECTRIC GAS LIGHTER IN SERVICE.

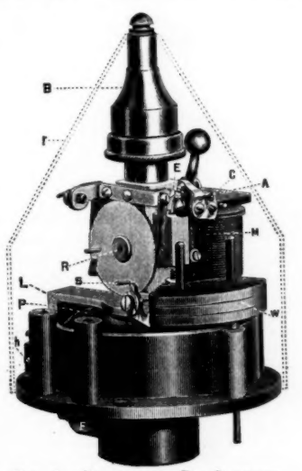


FIG. 2.—DETAILS OF GAS LIGHTER.

light the gas in a house supplied with automatic lighters.

The illustration, Fig. 2, shows the lighter about two-thirds full size. P is the pressure gauge or gas holder, sealed with mercury and held down by the weights W. When the gauge lifts it closes the electric circuit through the magnet M. The armature A is attracted and caused to vibrate, throwing sparks at E and turning the ratchet wheel R. The first movement of the ratchet wheel admits the gas to a small auxiliary outlet at E, as well as to the main burner. The electric sparks formed at E ignite the auxiliary jet, which immediately shoots up and lights the main burner. As the ratchet wheel continues to turn the auxiliary jet is closed, leaving the main burner open. The ratchet wheel is finally stopped, with the gas turned full on and lighted, by a pin in the wheel striking against a stop S, attached to the pressure gauge P.

It has been shown in practice that 15 seconds is amply sufficient for maintaining this increased pressure to give time to make the increase everywhere felt. It can then be brought back to normal pressure, when the pressure gauge P will drop back and open the electric circuit. This operation, if repeated, will extinguish the lamps.

The mechanism of the lighter is extremely simple, and made so strong as to insure it from getting out of order or requiring attention of any kind. A heavy cast-iron shell, three-sixteenths of an inch thick, shown by dotted lines in the illustration, entirely surrounds the mechanism and thoroughly protects it from all kinds of external abuse. No part of the lighter is exposed except the lava tip, which is easily replaced should it become stopped up or broken. An outlet at P provides a passage for pouring in alcohol should the gas freeze in the riser pipe in Winter. The iron battery boxes are supplied with covers flush with the ground, which are intended to be removed once a year for cleaning the batteries. This operation constitutes the entire operating expenses.

The burner used is the sub type and gives a yellow flame without tongues and very little blue. It will consume exactly the number of cubic feet for which it is set under extremes of pressure varying from one to five inches of water. The manufacturer of this apparatus is the Cutler-Hammer Manufacturing Company, 247 South Jefferson street, Chicago.

A New Westinghouse Factory.

It is reported that the Westinghouse Electric and Manufacturing Company will soon advertise for bids for the erection of its new factory at Brinton, Pa., about eight miles east of Pittsburgh, and by next year the entire electric plant will be removed from Pittsburgh and concentrated under one roof.

The friends of Mr. Westinghouse claim that his strong point is organization for the most effective mechanical work with the least expense, and in the new workshop, which it is claimed will have a capacity greater than the 22 factories of the General Electric Company, at Lynn; the arrangement will be such that all stores will be directly opposite each department, and raw material will go in and come out as manufactured product, with great saving in time, expense and energy. Huge electric cranes will be in position to move the heaviest machinery in the great shop, which will be 754 feet long and 231 feet wide. There will be a two story warehouse of the same length and a suitable power house. The present capacity of the company will be doubled and the output can be increased to above $1,000,000 per month.

The land at Brinton is purchased upon easy instalments from a homestead company. The Westinghouse Company is understood to be earning enough to pay dividends, but the expanding nature of the business requires the surplus earnings. The floating debt, however, is understood to have been decreased the past six months. The preferred stock is secured as to principal as well as dividends.

It is expected that the removal to the new works can be accomplished gradually in 1894 without reducing the company's output or forces. At present about 2,000 hands are employed, and business is considered satisfactory by the officers of the company.

The New York Gas Commission has decided to provide 143 additional electric lamps for annexed district streets for 1894. These will be distributed along One Hundred and Sixty-sixth, Birch, Kingsbridge and Orchard streets, and Bailey, Anderson, Boston, Elton, Claremont, Manhattan, Rider, Marcher, Riverdale and Undercliff avenues, Broadway, Featherbed Lane and Macomb's Dam Road.

ELECTRIC LIGHT FLASHES.

The electric light plant at Smyrna, Del., is nearing completion.

The electric lights at Swanton, Vt., will be started in a few days.

Work on the Newark, O., electric light plant is progressing rapidly.

Rendham, Pa., is likely to have an electric light plant at an early date.

The San Diego, Cal., city council has voted in favor of city ownership of the electric lighting plant.

Russellville, Ky., is preparing for electric lights. Hon. Wilbur F. Browder is the president of the company.

The new electric light company at Leroy, Ill., has completed its plant and is now setting poles preparatory to wiring the town.

The Wallkill Valley, N. Y., Electric Light Company has secured the contract for lighting the streets of Walden, N. Y., for one year, beginning January 1.

The town of Lebanon, N. H., has decided to run its electric street lights all night, as a safeguard against the lawlessness that has been prevalent there of late.

It is reported that the Westinghouse Company intends to bring the whole of its World's Fair lighting plant to New York, and will transfer it to the United States Electric Lighting Company.

A verdict was rendered in Pittsburgh, Pa., on November 21, in the United States Circuit Court case of the General Electric Company *vs.* the Connellsville, New Haven and Leisenring Street Railway Company for $12,023 in favor of the plaintiff. It was an action to recover for machinery sold.

The town council, of Kettle Falls, Wash., has passed an ordinance granting the electric light franchise to J. W. Reynolds for 20 years. The electric light plant was put in before the town was incorporated. The coming year Mr. Reynolds is to furnish street lights at $12.50 per month for each light.

An incandescent electric light plant for Fredonia, N. Y., is now an assured fact. The board of trustees has granted the electric railway company the right to construct an incandescent system for the purpose of lighting business places, residences, etc. The right given was not an exclusive one, and it is probable that other companies will also offer bids.

The Ballard, Wash., Electric Light Company went into the hands of a receiver recently on application from David M. McMullen, who claims to own 53⅓ per cent. of the stock. The application recites that the company was incorporated in 1891 with a capital of $25,000, divided into 500 shares of a par value of $50 each. The value of the property is placed at $5,000, a sum, it is claimed, inadequate to pay the outstanding debts, which amount to $6,100.

The new plant of the Woonsocket, R. I., Electric and Power Company is about completed and will be in operation in a few days. Water is the motive power for driving the dynamos, two pairs of 36 inch turbines developing 600 horse-power being used. Three generators, each of 150 horse-power will be installed. When the power plant is installed the company will rebuild part of the trench wall on the street and build a handsome building, and later will build another substantial building in front of No. 2 Mill.

The Newton, Mass., committee on street lights, to whom had been referred the order to investigate and report upon the advisability and feasibility of establishing a municipal gas and electric lighting plant in Newton, reported recommending that the city council take immediate action whereby the city may avail itself of all the privileges contained in the act of the legislature of 1891, entitled an act enabling towns and cities to establish and maintain plants for the manufacture and distribution of gas and electricity. The report was accepted.

A Canal Conference.

In answer to a call issued by the Joint Committee on Canals of the various exchanges and associations of the State, which are interested in canal improvements, nearly 200 delegates, representing nearly every city and town in the State which has any canal interests, met on Tuesday, December 5, at the rooms of the New York Board of Trade and Transportation, 203 Broadway, New York. On account of the recent successful experiments in electric propulsion for canal boats, the meeting promised to be of interest to electrical men, a few of whom were present.

The chairman, Mr. Harvey J. Hurd, of Buffalo, presented some communications which had been received. The first was from Governor Flower. He said in part:

"My observation convinces me that the principal need just now is for more rapid transit. With this idea, experiments have recently been made and seem to have been successful. If so, a new life of prosperity should begin for our canals. When it is abundantly demonstrated that electricity is the cheapest, the most efficient and the most practicable motive power, the course of canal developments will take new lines, and it would, therefore, in my judgment, be unwise to undertake any extensive enlargement until conditions would seem to justify the expense."

The governor's letter did not appear to meet with the entire approval of those present.

A second letter was read from Horatio Seymour, ex-State engineer and surveyor, in which the matter of canal improvements was gone into very deeply, and the result arrived at that improvements in the canals themselves should be made prior to any changes in motive power. This was received with much applause.

Subsequent doings of the conference showed further that the latter plan is one which the canal men themselves decidedly prefer. No antagonism toward electricity as a motive power in itself is felt, but the feeling is very strong that while electric propulsion may very probably be the method employed in the future, at the present time the canals need some attention in the way of improvements which should be given them before the further adoption of any motive power, whether mule, steam or electric.

Honoring Major M. P. Handy.

Major Moses P. Handy, the highly successful Chief of the Bureau of Promotion and Publicity of the Columbian Exposition, was dined and toasted at the Waldorf Hotel of this city, Thursday evening of last week. The dinner was given by New York newspaper friends of the guest, who desired in some way to testify to their appreciation of his able management of his department, and the courtous treatment they all received from him during the Exposition.

There was a representative newspaper gathering, presided over by Col. John A. Cockerill, and interesting and appropriate addresses were delivered, the occasion being highly enjoyable in every respect, adding another laurel to the brow of Mine Host Boldt, of the Waldorf.

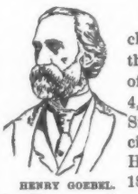
Among the newspaper men present were John W. Keller, St. Clair McKelway, Murat Halstead, R. E. A. Dorr, Joseph Howard, Jr., Foster Coates, Bradford Merrill, J. I. C. Clarke, Louis N. Magargee, A. Willis Lightborn, J. W. King, Maybury Fleming, Sheffield Phelps, George H. Fleming, William A. Deering, Jno. A. Hennessey, Jno. A. Sleicher, F. C. Clarke, A. B. de Guerville, C. H. K. Curtis, George W. Turner, William Bryant, William Berri, Thomas B. Connery, P. F. Collier, John Elderkin, Matthew Griffin, Charles W. Price, C. J. Smith, W. H. England, A. B. de Freece, J. B. McCormick, Blakely Hall, Anson Pond, Col. W. Hester, F. Ridgeway Griffith, Morton MacMichael, Henry L. Stoddard, James Bliss Townsend, Clarence Krum, Walt McDougall, Dr. John Freidrich, John R. Dos Passos, Herman Ridder, R. P. Porter, Dr. Edward Bedloe.

An Assignment.

The Lemaire Decorative and Electrical Manufacturing Company, of 50 West Sixty-seventh street, New York, have made an assignment to Jamin S. Morse. Cravath & Houston, attorneys for the company, said that the liabilities were less than $20,000.

OBITUARY.

HENRY GOEBEL.



HENRY GOEBEL.

Henry Goebel, who claimed to have invented the incandescent lamp, died of pneumonia on December 4, at his residence, 504 Sixth avenue, New York city, after a week's illness. He was born on April 20, 1818, at Springer, a village in Hanover, Germany. His father was a chocolate manufacturer of some prominence, and about 1820 was sent to New York as Consul for the Netherlands. Henry, as a watchmaker and optician, invented many new devices in the mechanism of clocks and watches, and experimented with lenses and optical instruments which he made. Later he went to the Technical School of Hanover, where he became interested in electricity, and, with one Professor Mönighausen, made a great many experiments with arc lights. About 1846 accounts were published in Europe of an incandescent lamp invented by J. W. Starr, of Cincinnati. Goebel had frequently constructed barometers and thermometers which required a vacuum, and Professor Mönighausen suggested attempting to make an incandescent lamp on that plan. The experiments that followed were unsuccessful. Goebel, however, continued his experiments while plying his trade of watchmaker, and earning a comfortable living.

Henry Goebel arrived in New York on February 2, 1849, and established himself and his family in a small house on Monroe street, where he hung out his sign as watch and clockmaker. The business supported him, and he continued his electrical experiments, chiefly with arc lights. He made a large arc light and set it up one night on top of his house and turned on the current from his dynamo. The people in the neighborhood did not know what to make of the brilliant glare, and very soon an alarm of fire was turned in. When the engines responded, and the cause of the alarm was learned, Mr. Goebel was arrested and hurried before a magistrate on a charge of "disturbing the public peace."

Goebel began extensive experimenting with incandescent lamps in 1850, using empty cologne bottles, with thick wire inside, arranged in the form of a butcher's meat saw. A thin copper wire was next substituted, and discovering that he did not obtain a sufficient vacuum, Goebel invented a mercury air pump. The wire filament worked badly and he searched for a substitute. One day, in burning out the wood from the ferrule of a broken cane, he noticed that portions which had been excluded from the air turned into almost pure carbon when heated. It was this that suggested to him the use of a carbonized fibre of wood in place of the metallic thread. Shaving off some strips from the reed stem of his pipe, he carbonized them and placed them in a lamp. They gave an excellent light, but were apt to break by expansion or contraction due to changes of temperature. From that he evolved the idea of making them in the shape of horseshoes or hairpins, whereby they admitted of considerable expansion or contraction without breaking. Before the war, Goebel built a large telescope and mounted it on a wagon, taking it out on the streets at night and charging a fee to look at the stars. He had batteries in the wagon, and a number of his incandescent lamps were mounted on a frame near the seat. When business was dull he would light the lamps, and thus attract a crowd.

In 1881 a company was organized in this city to make electric lamps. Goebel was taken into the company, which, later became financially involved and failed. In the many recent suits brought by the Edison Electric Light Company against alleged infringing manufacturers of incandescent lamps, Goebel's testimony has been of great value to the defense, especially in the cases of the Beacon Vacuum Pump and Electrical Company, of Boston, and the Columbia Incandescent Lamp Company, of St. Louis. Final decisions in these cases have not yet been reached, although the Columbia Company won in the suit for a temporary injunction on the Goebel testimony.

JOHN TYNDALL.

Prof. John Tyndall, the eminent English scientist, died at his house in Haslemere, Surrey, England, on December 4, from a complication of diseases, and an overdose of chloral administered by his wife by mistake. He was born at Leighlin Bridge, near Carlow, Ireland, on August 21, 1820. He was educated in the local schools, and in 1839 joined the Irish Ordnance Survey, where he acquired valuable practical knowledge as a draughtsman, computer, surveyor and trigonometrical observer. In 1848 he began the original researches which, continuing for 40 years, made him one of the foremost men of science of his day. Attracted by the fame of Professor Bunsen, he went to the University of Marburg in Hesse-Cassel. The investigation which first made him known to the scientific world was "On the Magneto-optic Properties of Crystals, and the relation of Magnetism and Diamagnetism to Molecular Arrangement." This investigation was executed with Professor Knoblauch, and was published in the *Philosophical Magazine* for 1850.

In 1851 Mr. Tyndall went to Berlin, and continued his researches in the laboratory of Professor Magnus. He soon, however, returned to London and was elected Fellow of the Royal Society in 1852. A year later he was appointed professor of natural philosophy at the Royal Institution, and he retained the office for more than a quarter of a century. He succeeded Faraday as superintendent of the institution.

All of Professor Tyndall's investigations were fundamental in their character. They were particularly directed toward the examination of the molecular constitution of matter, and he supplied, more than any other man of his time, the foundation upon which modern science rests. He did not confine his inquiries to any particular branch of physics. Heat, light, acoustics, electricity and magnetism, all were the subjects of his inquiries. Between 1849 and 1856 he devoted himself chiefly to experiments in magnetism and electricity, in the course of which he settled the question of reversed polarity.

ANTHONY RECKENZAUN.

Anthony Reckenzaun, who is probably best known for his work in developing and introducing the storage battery, died at London, England, on November 11. He was born at Gratz, Austria, in 1850, and received an excellent education. He went to London in 1872 and procured employment with a marine engineering company, where he secured experience which afterward proved of great value to him. After attending the Paris Exhibition in 1878, he studied electrical engineering under Professor Ayrton at Finsbury Technical College. The Electrical Exhibition at Paris in 1881 enabled him to become thoroughly acquainted with electrical apparatus in general. His work in connection with storage battery applications has been recognized as of value. In 1886 he built the electric launch "Volta," which made the voyage between Dover and Calais, and the trip from London to Dover. He did considerable work in this country on launches and accumulator cars, and read papers before the American Institute of Electrical Engineers and the National Electric Light Association. Mr. Reckenzaun was a member of most of the prominent technical societies, and was a frequent contributor to the electrical press.

Mr. George Westinghouse, Jr.'s, Opinion.

Mr. Westinghouse is understood to have declared recently that it was not pleasant to be quoted as saying he would not take the General Electric Company as a gift. He was not indulging in such talk—that was the function of Wall Street stock operators—he was attending to his legitimate manufacturing business, and knew little of the condition of the General Electric. The field was large for electric work and would not diminish, he believed, in the near future.

A New Automatic Fire Alarm System.

While the importance of a reliable automatic fire alarm system has been recognized for years, the subject has lately received more than usual attention from all interested, from the fact that lately the losses from fires have greatly increased, and in many sections the insurance rates have also increased. It is conceded by many of the best authorities that a reliable system of this class gives better protection against fire than a watchman, inasmuch as it is always on watch at all parts of a building at all times, and never sleeps or drops a lighted lantern or match. It is also very much cheaper to maintain than a watchman.

In many of the systems heretofore used, although they appeared well on exhibition tests, serious faults have developed in regular practice, largely due to that class of troubles which appear only after such apparatus has been in use a considerable time. The wiring of such a system must necessarily extend all over a building to be protected, crossing and recrossing it many times, which makes it particularly liable to accident by broken lines and short circuits. The service is also such that the system must be certain to act without a moment's delay and without any manual assistance whatever, even though it has stood for months without attention. In consideration of the above, the following have been laid down as axioms:

FIG. 1.—ELECTRO-MECHANICAL GONG USED WITH BROWN'S AUTOMATIC FIRE ALARM SYSTEM.

First—Any system, to be entirely successful, must be of such a nature that any accident to the battery or wiring that will render the system inoperative, will at once notify the attendant at the receiving station without sounding a fire alarm. In short, a system must watch itself and notify whenever it needs attention. It was this feature of watching itself in the new Westinghouse automatic air brake, that has caused it to displace all other types of brakes and its use on almost every railroad in the world.

Second—It must be prompt and sure to act and entirely unaffected by dust, insects, moisture, foul gases or jarring of the building, etc., and require no readjustments.

In the interests of economy, such a system should require but very little current to operate it and be easy and cheap to install. Any system which does not embody all these features, cannot be entirely satisfactory in practice.

The first axiom not only makes it necessary that the system shall be closed circuit, but that the entire current required to give the alarm shall flow all the time; otherwise the extra batteries and lines intended to be brought into action by the thermostat may not be operative. All closed circuit systems which depend upon breaking the circuit to sound the alarm, are subject to the fatal fault of sounding false alarms whenever the line is broken or short circuited by accident. This is one of the most serious faults to which automatic fire alarm systems are subject, and the one which the fire departments most strongly condemn. To obviate this, it is necessary that the thermostat in acting shall make some change in the line which is never made by accident, and that the receiving instruments be so arranged as to indicate what change has taken place.

In the system in question, by very simple mechanism, the thermostat in acting reverses the current instead of simply stopping it. Reversing the current is a change which never occurs by accident; hence, the receiving instrument will never indicate fire unless a thermostat has acted. The receiving mechanism consists of a very simple and reliable electro-mechanical gong, controlled by a polarized armature of the rotary type, to which is attached a pointer moving over a suitable dial arranged to show just what change has occurred in the line. This dial is marked "O. K." on its right hand end, below which are the words "Battery Run Down," in the middle "Line Broken," and on the left hand end "Fire."

The magnet and armature are of new and unique design, giving a long movement of the latter with a very small current. This enables the system to be maintained at a very small expense, the battery used being the common gravity. The polarity of the armature of this magnet can never be reversed by any of the accidents to which the system is subject, nor will it ever stick to the poles of the magnet or require readjusting. This armature is brought to center by small weights which, in practice, are more reliable than springs. A very important feature of this apparatus is the fact that the battery current can rise much above or fall much below the normal without affecting the working of the system. This system can be arranged with two bells, one of about eight inches diameter in the engine house to ring for fire only, the other of small size to call attention to trouble with the line. A large striker is also provided to strike a factory or other large bell one blow to indicate trouble with the line, and continuous ringing to indicate fire. This is important in places where firemen are not on duty at all times.

One of the most important features of an automatic fire alarm is the thermostat, upon which, to a large degree, the efficiency of the system depends. The one illustrated in Fig. 2 has been the subject of a great deal of study and experimenting, and is believed to embody more good features than any other ever devised, and no bad ones. Its construction and operation are as follows:

Upon the lower side of a porcelain base are clamped two flat bronze springs, which are held under tension by a fusible solder, the melting point of which can be changed to suit different positions. To the upper side of this base is clamped a plate of vulcanized fibre, through which screws pass into the ceiling to fasten the thermostat in position. In the center of the porcelain base, and covered by the fibre plate, is molded a cavity which contains electro-plated contact points, brought into action by releasing the springs. These contact points are punched from sheet brass and rivetted to the bronze springs, extending through the porcelain into the cavity referred to, and so arranged as to press against suitable electro-plated copper strips, connected in such a way as to reverse the current when the springs are released by melting the solder. The working parts of this thermostat are entirely protected from dust and insects, causes which render a large percentage of those now in use entirely inoperative after they have been in place a year or two. The part sensitive to heat is entirely uncovered, and in the best possible position to be affected by direct rays as well as the heated air from a fire, and being thin acts promptly and will never change its adjustment. These are very important features. The contacts being made on clean metal and with considerable pressure are sure to be good, and the electric contacts with the line wire are such as will never become loose or cut the wire. It is entirely unaffected by jarring of the building or the warping of the wood to which it is fastened; nor is it at all affected by being wiped or brushed. The action of the system is as follows:

In case the battery should be allowed to run down, the armature would be drawn towards its central position by the weight until the hand pointed to "Battery Run Down," when the striking mechanism would be unlocked and the bell strike. The attendant, on looking at the dial, would see that the bell is striking because the battery is run down, and to silence the bell turns over the small handle on the left hand side of the case, which, besides stopping the striker, turns up a card over the dial marked "Disconnected," which shows that the system is inoperative. Even under these conditions the system will sound an alarm in case a fire should occur, unless allowed to stand too long. In case of a broken line or short circuit (which in this case is equivalent to a broken line), the same thing takes place, excepting that the pointer indicates "Line Broken." In this case, when the line is repaired, the bell again strikes to notify the attendant that the line has been repaired, and the hand points again to "O. K.," the bell being silenced by turning the lever and card back to the original position. In case of fire the bell rings and the pointer is carried to the word "Fire," and locked in that position, where it remains until released by the attendant.

It will be seen that this system is entirely free from relays and local circuits, which in practice have been found to be unreliable. In the arrangement of the commutator and public alarm bell, with which this system is provided, no element is introduced that can possibly interfere with the action of the engine house gong, bearing in mind that the action of this bell is by far the most important function of the system. With this in view, care has been taken that its action should not depend upon anything delicate or uncertain, or be in any way interfered with by the failure of the other instruments. It will also be seen that this system, unlike those commonly in use, requires no manual testing, it being so arranged as to constantly watch itself and notify the attendant whenever it needs attention. Manual testing of isolated systems of this class is found to be very unsatisfactory in practice, because it is almost impossible to induce an attendant to give them attention after the novelty has worn off, and automatic apparatus to accomplish this result is far too complicated to be reliable. In consequence of this, many systems have become inoperative when supposed to be all right, and have failed to respond when a fire occurred.

This system, while much simpler than those in common use, contains none of the features which have in practice rendered the older types objectionable. All the details, including many heretofore neglected, have received careful study, with a view to making this apparatus such as can be depended upon under the conditions of actual service. It was designed by Mr. Gilman W. Brown, of West Newbury, Mass., who has devoted the last four years to perfecting its details, and is fully protected by patents.

ELECTRIC RAILWAY AND POWER NOTES.

The Hartford, Conn., Street Railway Company have just received a new electric snow-plough from the works of the builder, J. W. Fowler, of Elizabethport, N. J.

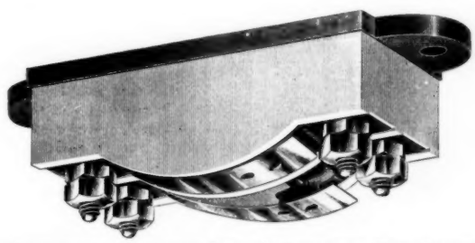


FIG. 2.—THERMOSTAT USED WITH BROWN'S AUTOMATIC FIRE ALARM SYSTEM.

The South Worcester, Mass., street car line, which has been equipped with electricity, was put into operation on November 20. There are now no horse car lines in Worcester.

John Jacob Astor has just had a large dynamo placed in the engine house on his dock at Rhinebeck, N. Y., in the Hudson, and with it will light by electricity the mansion and grounds of Ferncliffe.

The executive board of the Bridgeport, Conn., Traction Company informed the members of the city government on November 22 that they intended to spend between $600,000 and $700,000 in their improvements on the road.

Citizens of the Delaware Water Gap are talking strongly of building an electric railway to the top of the mountains on the Pennsylvania side. It is believed that the enterprise would greatly add to the attractiveness of that noted Summer resort.

The boilers at the Elwood, Ind., electric plant exploded on Nov. 29. The building was a one-story, double-brick, one-half being used by the Elwood electric street railway as the car house. The building is a complete wreck. There were four persons in the building at the time of the explosion, but none was fatally hurt, though all were injured.

There is at Columbia, S. C., a nearly completed cotton mill which is to have its power brought from the canal by means of electricity, instead of the old-fashioned belt method. The equipment of machinery is the best that has yet been turned out. The product of the mill will be cotton duck. The general manager is Mr. C. K. Oliver, a Baltimore man. A Boston man, Mr. Stephen Green, is the engineer. The capacity of the mill is 45,000 spindles.

An Ohio law requires that every electric street car shall be provided from Nov. 1 to April 1 with a screen of glass or other material which shall completely protect the motorman or gripman from wind and storm. Heavy penalties are attached for violation of this law. The company neglecting to make the required provisions are liable to a fine of not less than $25 nor more than $100 a day for each car not provided with the vestibule specified in the statue.

Advices from Chicago state that the prospect of having to pay damages twice, as a result of a failure of the American Casualty Insurance and Security Company, stares a number of Western street and steam railroads in the face. They have already paid the Casualty company to relieve them from liability, but the Casualty company, being insolvent, cannot do this, and any judgments secured will have to be settled by the railroads themselves. Among the companies that have done business with the Casualty company, and which are affected to a greater or less extent by its failure, are the North and West Side Cable Roads in Chicago; the Chicago and Eastern Illinois; the Calumet electric and street railroads in Minneapolis, St. Paul, Kansas City, St. Louis, Peoria and Springfield. The amount for which these companies may be caught depends on the amount of litigation pending and the outcome when the cases come to trial. Only the books and records can show how many cases there are, though there must be hundreds of them, and the amounts involved will foot up a pretty big figure.

The annual meeting of the stockholders of the West End Street Railway Company was held recently in Boston. There was a large representation of stockholders. By the vote for directors the next board will be decidedly different from the old one. Six of the old board of 15 retire. They are Isaac T. Burr, Prentiss Cummings, Joseph S. Fay, Jr., William Powell Mason, Dexter N. Richards and Nathaniel Thayer. The new members of the board are: Alfred Bowditch, Francis L. Higginson, William Hooper, B. Rodman Weld and Alfred Winsor, all of Boston, and Samuel Spencer, of New York. The following were elected directors: Alfred Bowditch, G. T. W. Braman, Eustace C. Fitz, F. L. Higginson, William Hooper, Walter Hunnewell, Henry D. Hyde, Eben D. Jordan, Samuel Little, Theophilus Parsons, Samuel Spencer, Walter S. Swan, B. Rodman Weld, Henry M. Whitney, Alfred Winsor. The total number of votes cast was 147,602, and all received that number except Eustace C. Fitz, who received 147,580; Henry D. Hyde, who received 147,594, and Samuel Little, who received 147,578.

Edison Lamps Reduced in Price.

As announced in the advertising columns of this issue of the ELECTRICAL REVIEW, the General Electric Company has reduced the price of Edison incandescent lamps. The price hereafter will be 32½ cents each in any quantity. Whether the reduction is due to competition by the "outside" lamp companies or whether the General Electric Company is trying to force out the "outsiders" by cutting prices cannot be learned.

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A reliable life guard for trolley cars has come to be almost a necessity. A device of this kind which seems satisfactory is described elsewhere in this issue.

The snow plow and the electric heater now receive the attention of the wide-awake railway manager. Keep your plows bright and ready, and may you find what you want in the electric heater.

The successful trial of electric power on the Erie canal has had an immediate effect outside of New York State. Preparations are already being made for similar experiments in two other States.

Mr. Gilman W. Brown's automatic fire alarm system, which is fully illustrated and described in this issue of the ELECTRICAL REVIEW, appears to be a most simple and ingenious apparatus for the performance of a very important service. It seems to be free from many chances of failure which have been observed in other and older systems.

The death of Henry Goebel removes from the electrical stage one of the most unique figures that ever held a part in the cast of electrical progress. Whatever may be the decision as to Goebel's claim to the invention of the incandescent lamp, the fact remains that he was a man of considerable attainments in many ways, and it is to be regretted that he could not live to see the lamp question finally settled.

An electrical combination safe is a device which would be worthy of a practical inventor. The existing combination locks are complicated, delicate and expensive. An electrical combination lock might be made simple, inexpensive and practical, easily adapted to the existing styles of safes, and would no doubt find favor in the eyes of those safe manufacturers who are dependent for their locks on the numerous lock companies. Then again, the safe might, in addition, be provided with the latest and most improved electro-photographic burglar detectors.

RED-TAPE VS. BUSINESS.

Can any one tell us what has really been accomplished by the Rapid Transit Commission? Since the subject was first agitated prior to the passage of the law creating the commission, enough time has elapsed to have planned and constructed several rapid transit systems, all of which could be in full operation to-day, if ordinary business methods had been resorted to the same as would be the case in any private or corporate enterprise wherein politics and red-tape are unknown. The rational and business course, however, is the last one to be adopted in municipal matters, and the long suffering citizens who pay for all this humbug are cooly told to wait a bit longer.

If any of our great trunk lines had the right to traverse the city and wanted to do so, would it appoint a commission of its oldest and most respectable stockholders—"grave and reverend seigneurs"—to decide promptly questions involving only the best skill of the engineer, the wisdom of the manager, the acumen of the train dispatcher and the earnest work of the inventor? Would it wait three or four years for these fossils to decide for it the proper way to disburse millions and millions of dollars? Would it pay for such useless advice several hundred thousand dollars? A thousand times no! The company would first decide that, if feasible, the thing should be done. Then a corps of engineers would be put at work to produce as rapidly as possible surveys, plans and estimates for each available route which could be found, and the executive officers would make their selection and the work would be under way within six months from the first suggestion, had our needs been entrusted to the right kind of men.

Had the commission attended strictly to business and trained itself in abolishing red-tape and the anti-enterprise of commissions generally, we would have rapid transit in full swing to-day, and real estate would be richer by millions of dollars, apart entirely from the question of convenience. Why should the Manhattan be jumped upon? Who jumps upon it? Is there a citizen to be found in all the vast throng of people who ride down town every day, who objects to the third track on Ninth avenue? Not one. There is no sense in such opposition. Such a third track insures an express time of 20 minutes to the Battery, hurts nobody but a few officials whose only objection can be that it is informal, that proper proceedings were not taken, and that *their* permission was not asked. Faugh!

Let us look at this thing justly and fairly. If the elevated railroad had not been made to pay a cent for its franchise, nor a dollar for its continuance in the shape of a tax on its gross receipts, it would still deserve well of the city. Suppose for an instant it were wiped out of existence; what would our people do? The surface cars could do no more than they are doing now, unless they were trolley-ized. Leaving Harlem aside for a moment, how would the throngs get along which daily circulate between the Battery and Fifty-ninth street? How would rapid business trips be made? What would become of the army of shoppers who daily visit us from the east, west, north and south suburbs? They would stay at home and their money with them. What would become of the hundred million dollars increased valuation in uptown property, caused by the operation of the elevated railroad? There are two sides to every question, and we do not think both sides of this have been fairly weighed. Many of the men who now declaim against the Manhattan Company most loudly have been enriched by its advance into suburban and one-time inaccessible districts. They ought to be consistent and try to give it every chance possible. Let their efforts go in the direction of the adoption of electricity and they will be doing a universal good. Give the Manhattan its third track if, by doing so, we get the boon of high speed. Insist upon electric traction, if, by doing so, we get more comfort and less dirt and noise.

Let the Rapid Transit Commission resign, let the legislature pass a new law infusing some business methods into the question, and then let us have action, not fossilized deliberation about nothing. Starting entirely afresh in January, the whole question could be satisfactorily settled and the roads built inside the limits of 1895. The east side and west side plans said to have been at last adopted by the "rapid-rancid-fossils" are nothing but competitors for existing business, and lack all the essentials of high-speed travel. Away with the red-tape and the present commission, and put the whole question on a business basis, and the franchise will quickly be taken under conditions which will assure the city an electric system, perfect in every detail.

MUST THE CANAL MULE GO?

The canal men in conference assembled, as described elsewhere in this issue, seem to think the mule is destined to exercise his majestic sway over canal boat transportation for some time longer, or, if not that, they seem to think that the industry of canal transportation needs at present other attention than in the direction of usurping the place of the mule by the more tractable electric motor.

Governor Flower was unable to be present at the meeting, but sent a letter, in which he alluded with pride to the recent experiments with the trolley canal boat near Rochester, but seemed disposed to look with disfavor on appropriations for the improvement of canal bottoms. The delegates could hardly agree with the Governor, and one gentleman from Whitehall grew quite excited in expressing his views of the Governor's opinions, and had to be called to order by the chair.

The opposition to electricity as a motive power is only apparent. The canal men are energetic and progressive citizens, want the best, and are bound to have it, so it will be only a question of time before they have electric power, but—they want the canals first put in the shape which the best engineering talent suggests. One man compared the situation to an attempt to equip an old broken down street railway with the latest and best electrical apparatus leaving in 12 or 15 pound rails and the wooden stringers of several decades ago.

The Brooklyn City Railroad Company will equip 1,000 of its cars with life fenders. This is truly progressive, and here are some sensible things said by President Lewis:

"To nobody in Brooklyn has the sacrifice of human life by the trolley been more revolting than to the officers of this company, and we determined to take every possible precaution for the safety of the public. The fender adopted is not an infallible life saver, but the experience with it in Boston shows that up to date it is the most effective product of human ingenuity. Neither time, trouble or expense will be spared in securing improvements upon it."

In honoring Major M. P. Handy the New York newspaper men have done the right thing. We think we voice the opinion of the technical and industrial press of the world when we say that he proved to be the right man in the right place. His department was at once placed in touch with this important and influential branch of newspaperdom, and there was a harmony and concentration of effort that proved invaluable to the success of the Fair. The ELECTRICAL REVIEW extends most cordial congratulations to Major Handy, and hopes that he may receive full honor for the great work he accomplished.

How would a Christmas gift of a year's subscription to the ELECTRICAL REVIEW please your young electrical friend? It would make him happy for fifty-two weeks.

CORRESPONDENCE.

OUR WESTERN LETTER.

The National Electric Company are again in operation with the successful Ides at the helm, and users of alternating apparatus will find it to their interest to correspond with them.

Wynn Meredith and Sudney Sprout, who were employed under Mr. Pierce at Jackson Park, will assist Lieut. Hasson in installing and operating the electrical plant at the Midwinter Fair in San Francisco.

President W. N. Brunbach, of the Beatrice, Neb., Rapid Transit and Power Company, is reported to have commenced suit against the receiver of the plant for incompetency and intent to depreciate its value.

Mr. C. F. Foster, chief mechanical engineer at Jackson Park, was recently tendered a reception and banquet at Kinsley's, and presented with a testimonial by his immediate staff, Mr. C. O. Billow making the presentation speech.

Continuous Feed Arc Lamp.—Central Station managers interested in securing a lamp having a strong, simple mechanism, should send for a copy of the circular describing the Nutting arc lamp, to Bartholomew, Stow & Company, 57 Michigan street, Chicago.

Mr. Frederick Bathurst, of the Edison Works, has been called home by the serious illness of his father, and left on the steamer Majestic on Wednesday. For the present his address will be No. 111 King Henry's Road, South Hampstead, London, England.

Ideal Comfort.—That is what users of the new Columbia opal incandescent lamps enjoy. These lamps are made in the usual bulb form, and in candle shape, and are the neatest and best lamp for general use yet placed on the market. For use around the desk, the drawing table or in the library they are simply perfect.

Mr. William Taylor, 348 Dearborn street, Chicago, has had his offices and storeroom repainted and decorated, and additional furniture added, thus enabling him to handle the increase in business more effectively. Few more justly deserve the success that now is coming his way, and thus his friends will rejoice in the bright outlook.

William A. Merrill, Jr., 157 La Salle street, Chicago, will make his next report to the Electrical Committee of the Underwriters' International Electric Association about January 10, 1894, and full details of the cause of any fires charged to electricity should be sent to him. Especial care should be observed in tracing up the cause of fires that may be blamed to lamps used in holiday displays.

Public Gas Lighting.—An extended test of the Cutler gas lighting device has shown that there is no perceptible change in the illumination from private jets by the increase in the pressure on the mains. Desired results could be secured by decreasing the pressure when extinguishing the lights in the morning, but a reduction in the pressure of the mains might result in extinguishing night lights in residences and stores.

Mr. Alexander Dow, city electrician of the city of Detroit, has already buried 80,000 feet of conduit where it will do the most good, and is now figuring on the purchase of the best insulated wire in the market. As there are no fairer maids than Detroit's fair sex, as the sleighing is first-class, and the Cadillac has no superior, surely Fate is kindly disposed toward the representatives of the insulated wire manufacturers.

Mr. George G. Carter and G. L. Thayer have formed a co-partnership under the title of George G. Carter & Company, with offices at 1563 Monadnock Building, Chicago. For seven years past Mr. Carter was associated with the Electrical Supply Company, and is well known throughout the West. Mr. Thayer was formerly with the Westinghouse interests. Already a number of specialties have been secured and others are promised.

The General Electric Company have presented to the Field Columbian Museum, Chicago, the first dynamo ever used for incandescent lights; the first steam dynamo ever used, and best known among the fraternity as Edison's "Jumbo;" and the cases of incandescent lamps that formed the first commercial exhibit ever made. The historical value of these gifts is unquestioned, and it is hoped that this generous action will stimulate others to do likewise

The Rose Electric Light Supply Company is now occupying more commodious and convenient quarters at 202 and 204 South Third street, St. Louis, where its rapidly expanding business can be handled to better advantage. There are 1,400 arc lamps suspended from the ceiling, while on the floor are 67 large machines, including Brush arc dynamos, National and Westinghouse alternators, transformers, and Edison generators. In other words, purchasers desiring second-hand machinery can find almost anything in the line of electrical apparatus.

Chicago, December 9. F. DE L.

OUR BOSTON LETTER.

Mr. Frank H. Underwood, president of the Underwood Manufacturing Company, has received a letter from Mr. Robert Hill, chief engineer of the Chicago City Railroad Company, in which he states that the two 62 inch cotton-leather belts furnished his company about a year ago were, during the rush of travel incident to the Exposition, frequently loaded down to over 3,000 horse-power. They stood the strain perfectly and have always given entire satisfaction. Business with the Underwood Manufacturing Company is improving, and Mr. Underwood reports the receipt of several large orders.

Mr. Frank Ridlon, the widely known dealer in all kinds of second hand electrical apparatus, just added an important factor to his business by the purchase from the General Electric Company of their extensive repair shops at 180 Summer street. In speaking of general business, Mr. Ridlon states that the hard times and financial stringency of the past Summer has proved beneficial rather than otherwise to his business, as it brought many people to him as purchasers of something in the way of second hand apparatus which would bridge over their requirements until such times as heavier pocket books would permit of their indulging in new machines. He consequently has no fault to find with the situation, and is kept constantly busy in his large repair department from the same cause.

The W. S. Hill Electric Company, of this city, have changed the location of their New York office from 122 Liberty street to the Central Building, 141 Liberty street, where it will remain for the future. They also report that the Philadelphia Traction Company, to whom they recently shipped a large order of special switches and switchboards, have duplicated part of their original order, in which is included another of the 400 ampere switches. This is particularly gratifying to them, as the apparatus was built from special designs of their own, and on an exceedingly large scale and the early duplication of the order is a conclusive proof of its efficiency. They have been obliged within the past two weeks to put in additional machinery and employ more men, and are now using every effort to keep up with their orders. Among the large switchboards now under construction is one for the Boston *Herald*.

It speaks well for the management and efficiency of the West End service that travel was subject to very little delay and no interruption during the howling blizzard which struck this city on the 4th inst. The company were thoroughly prepared for the emergency, and by the aid of snow plows and increased power, kept their cars moving throughout the worst of the storm. Indeed, were it not for the West End Company the public would fare badly indeed, as the city authorities make absolutely no effort whatever to remove the snow, even from the crossings, and pedestrians are compelled to wade and flounder about as best they can. Rubber boots are a necessity, and are worn largely by both men and women. I noticed to-day for the first time half a dozen small carts and about twice as many men endeavoring in a compulsory sort of way to clean up a little in the heart of the dry goods district, but that was all. I attribute even this public attempt solely to the nearness of the city election, as during the whole of last Winter not a shovel full of snow was removed from this district, and for over two months pedestrians struggled through six inches of slush at every crossing. The West End Company have hundreds of teams and a large force of men working along its various lines, and to them the citizens are indebted for what little comfort in the way of travel they can get.

Boston, December 9. H. G. T.

National Electric Light Association.

The committee on arrangements of the National Electric Light Association held a meeting to consider hotel facilities and other matters at the office of Royce & Marean, Washington, D. C., on December 9. There were present Chairman C. O. Baker, Jr., S. M. Bryan, Fred. W. Royce and Secretary Geo. F. Porter, of the Association, who is an *ex-officio* member of this committee. Hotel arrangements were not finally decided upon, as Chairman Baker desired to consult with President Armstrong, of the Association, before a decision was made. Considerable routine business was transacted.

Chairman Baker has added these names to the committee on arrangements: A. A. Thomas, president of the United States Electric Lighting Company, Washington, D. C.; S. W. Tulloch, secretary of the same company; Frank H. Clark, Washington agent of the General Electric Company; M. D. Law, of the Love Electric Traction Company, Washington, D. C.; and C. A. Bragg, Philadelphia agent of the Westinghouse Electric and Manufacturing Company.

The United States Electric Lighting Company, of Washington, has offered to furnish current free to all exhibitors who may have apparatus to show at the hotel selected as headquarters. There will be no exhibition under the auspices of the Association.

Wall Street and the Electrical Stock Market.

The market during the period under review has been discriminating, narrow and largely professional. We note a continuation of the demand for good bonds, and what are usually termed, sure dividend paying stocks. On the whole the sentiment was rather more bullish than bearish although the net gain for the week was very small. A factor which caused some uneasiness was the engagement of a small amount of gold for export under the triangular movement rendered possible by the difference in exchange between London, Berlin and New York. The uneasiness was largely sentimental and had little or no effect. All intelligent interests recognize that the New York money market is now the cheapest in the world, owing to the plethora of funds. The rate here is, say 1½ per cent. against 4½ per cent. in Berlin. The maturing of sterling loans in the face of these two rates, naturally caused owners to place the capital where it would draw the heaviest interest. Consequently they were not renewed, but on the contrary the principal was called for. During the previous exporting period of this year the banks furnished their customers with currency on which was obtained gold at the Sub-Treasury, thereby lessening the Government's gold reserve. The gold thus far engaged was furnished direct by the banks. If other shipments are made, and they seem likely, the banks will furnish the metal, as they have some $40,000,000 of gold on hand. This will have the effect that the Government reserve will not be decreased.

There is no doubt but what the security market is reflecting business conditions, which are waiting for the Tariff bill to take such definite shape so that it can be discounted. This hesitancy is but natural and has the one effect of checking a revival of trade. So far as can be learned the administration is in a muddle over the bill, owing to sectional protests against its various clauses, and the necessity of providing a revenue not only to meet the deficiencies which it will cause in the tariff income, but the deficiency which already exists.

This uncertainty has rendered capital cautious to the extent of keeping it out of the investment market. So far as can be seen, this is a condition which will last for some weeks.

The bank statement was a favorable one, as it shows that there is something of a check to the increase in deposits. While deposits increased $5,457,100, loans increased $2,853,500, in reality cutting deposits one-half.

As has been the case for some time General Electric and Western Union were the only stocks of the electrical list that were at all active. Western Union, which was worked up into the nineties last week, had a sharp reaction on a selling out of parties who were bulling the stock. This was said to be upon knowledge that the report would show a falling off for the September quarter in net earnings of $400,000. Mr. White who was undoubtedly responsible for the advance, was credited with selling between 5,000 and 10,000 shares. The report will be out next week. It is an open secret that the gross earnings have fallen off heavily, but there have been large decreases in expenses which will have a tendency to off-set this. A contemparary publishes the following table showing the financial position at the end of the December quarter, 1892. It is as follows:

Net for December, 1892, quarter.	$2,000,000
Interest and sinking fund.....	243,335
Applicable to dividends.....	1,756,665
Dividends on the stock issued....	1,185,000
Surplus above dividends.....	571,665
Allow for loss this year of.....	400,000
And the surplus will be.....	$171,665

It was reported this morning that the company had put 30 men in the main office on the waiting list for a week; that it will keep the waiting list up to that figure until the whole force had been laid off one week. It is declared that this action was due to a lack of business, which is said to be only half of that of a year ago.

The stock during the latter days of the week was steady between 89 and 90. There is no talk, so far as we can learn, of a reduction in the dividend rate. The collateral Trust 5's were in limited demand, and strong at 107, showing investment buying.

General Electric was weak all the week with spasmodic rallies. The passage of the dividend on the preferred stock put a different aspect on the affairs of this company, as it made still more remote the resumption of dividends on the common stock. The secret of the weakness in the stock is just this: 33 to 35 is too high a figure for a stock that is not paying dividends, or has no prospect of paying dividends for a year at least. Were it not for strong support, which, logically considered, will not continue indefinitely, the stock would now be selling lower. The highest points reached on Monday and Friday being 35¾ and 35⅛, respectively. The stock touched 32½ on Wednesday. The Debenture 5's showed some weakness, selling between 72 and 70, the last quotation being 71.

Edison Electric Illuminating sold in a limited way at 97 to 97½. The bonds were in good demand at 104 to 105.

Messrs. Blodgett, Merritt & Co., of Boston, offered this company's first mortgage five per cent. gold bonds, due March, 1910, at 103½ and accrued interest. These bonds are convertible into capital stock until 1895 at holder's option, and are redeemable at 110 and interest after 1900 at the company's option.

Earnings of the company for the first nine months of 1893 were: Gross, $956,669; net, $441,124; as against $963,021 gross and $475,137 net for the year 1892.

The balance of the electrical list was without special feature. North American showed a little more activity than is usual between 4⅛ and 4⅞. American Telegraph and Cable was quoted at 87 to 88. One sale of American District Telegraph was made at 40 on Monday and a second sale at 46½ on Tuesday. Commercial Cable was not traded in, although inquiries were made for it at 120, and it was held strongly at 150.

On the Boston Exchange, General Electric preferred showed further weakness, selling as low as 52, from which it rallied to 60 in the latter part of the week. This, of course, was on the passage of the dividend. Bell Telephone fluctuated between 184½ and 188½, the latter figure being the closing. Erie Telephone showed weakness between 40 and 42½. New England Telephone was weak, selling down from 55 to 52. Fort Wayne Electric dropped from previous quotation, being bid three and held at three and one-half. Westinghouse Electric preferred was bid 46 and held at 46¼. The assenting certificates were quoted at 25¼ asked and 26 bid.

New York, December 9.

PERSONAL.

Mr. C. M. Morse, of the Buffalo Engineering Company, Buffalo, N. Y., was a visitor to New York city recently.

Mr. E. G. Bernard, of the E. G. Bernard Company, Troy, N. Y., was in New York city the early part of this week.

Mr. Stephen Wilcox, of the Babcock & Wilcox Company, died at his residence in Brooklyn on November 27, 1893.

Mr. Chas. A. Lieb, consulting engineer on electric railway specialties for the General Electric Company, has resigned from that position.

Mr. Charles R. Huntley, general manager of the Buffalo General Electric Company, Buffalo, N. Y., was a Metropolitan visitor last week.

Mr. Frank R. Chinnock, of 18 Cortlandt street, New York, has resigned the sales agency which he had for the Ball Engine Company, of Erie, Pa.

Mr. S. A. Douglas, until recently with the Chicago office of the Brush Electric Company, has come to New York and accepted a position with the General Incandescent Arc Light Company.

Mr. C. O. Baker, Jr., attended a committee meeting in reference to National Electric Light Association matters at the office of Messrs. Royce & Marean in Washington, D. C., last Saturday, and afterward went on to Chicago.

Mr. A. H. Lewis, formerly with the electric railway department of the General Electric Company, is now with the Curtis Electric Manufacturing Company, of Jersey City, N. J., a company which bids fair to be an important factor in the electric railway field.

Mr. George Alexander McKinlock, the energetic president of the Central Electric Company, Chicago, was a New York and Boston visitor last week. This company has many large interests in the East, which require a visit from the official head from time to time. No company in the business closes the year with a better record, both for business done and low percentage of losses, than this well established and well managed electrical house.

Mr. Schieren lately ran as candidate for the Mayoralty of Brooklyn. His oldest son, Charles A Schieren, Jr., and himself are as "chummy" as a father and son could be. Young Charles is associated with his father in the leather business in this city and has charge of the advertising department.

"I had Charles manage my campaign," said the Mayor-elect to me, "because advertising men are the brightest and most knowing men in the world, and Charles has shown that he is not behind the others in his line."—*Fame.*

The Electrical Transmission of Power From Niagara Falls.

ABSTRACT OF AN ADDRESS READ BEFORE THE INSTITUTION OF ELECTRICAL ENGINEERS, LONDON, NOVEMBER 9, 1893, BY PROF. GEORGE FORBES.

A few years ago it would have been considered necessary to devote a considerable amount of space to the discussion of the relative merits of direct and alternating currents. During the last two years, however, opinions have advanced so steadily in the direction of preferring the alternating current for the transfer of power to any considerable distance, that it is not necessary to give much time to this question. One of the chief difficulties in connection with using the direct current is that it is necessary, for getting the best results, to connect a number of dynamos in series, and also to put the motors at the receiving end in series with each other. This involves the insulation of each dynamo and motor from the earth, a requirement which can in some cases be attained, but which in a general system of distribution is apt to be attended with difficulty, and perhaps with danger. The best case of the kind which has been put in practice is that of Genoa, and we gave it the most serious attention, but came to the conclusion that, for our purpose, it was undesirable.

The facility which the stationary transformers used with the alternating current give for varying the pressure according to the requirements of economy or safety, is one great feature in favor of the alternating current. The question was considered in all its bearings with the utmost care, and it was not until the month of May, 1893, that the board of directors passed the resolution to adopt the alternating current both for their distant transmission and also for the works nearer to the power house.

The argument that seemed to me the most important in favor of using the direct current was that motors for this purpose have been made in much larger quantities than alternators, and that it would be seldom necessary to build special types of machines to act as motors. This advantage seemed to be of great importance, until I realized the value of a low frequency used with the alernating current. So soon as we reduce the frequency low enough, we are able to alter a direct current motor into a synchronizing alternating motor, by the simple addition of a couple of rings placed on the commutator and electrically connected with opposite bars of the commutator, and a brush rubbing on each of these collecting rings. I also took into consideration the question of the possibility of storing up energy in storage batteries during the night time, when, of course, the demands on our plant would be least, and giving it off during the daytime; but at the present time the cost of the batteries would not repay work in this direction, and it would be cheaper to make another tunnel, with wheel pits, turbines and all the paraphernalia required to generate current, than to go to the expense of putting down the large amount of lead which is required for these batteries. With the alternating current we have the choice of a considerable number of motors of different types. We have the synchronizing motor, the series-wound motor with laminated field and commutator, the multiphase motors which attracted so much attention at the Frankfort Exhibition of 1891, and a host of single phase motors which have been developed by various inventors, but which have never been placed on the market because of the high frequency which has been prevalent, and with which they were not altogether satisfied. These motors become immediately available if we use a lower frequency. The generation of an alternating current also permits of the use of a commutator, or rectifier, with direct current motors.

Assuming now that it is generally agreed that the alternating current must be adopted, not only for the distant transmission, but also for the nearer work, the next point to consider is the number of phases—whether the current should be generated in a single phase, in two phases, or in three phases. The possibility, too, of using even a greater number of phases was also considered, but it did not seem to possess advantages.

For all heavy work which is going on constantly without stopping the machinery, no motor could be more suitable than the synchronizing alternator on a single phase, and its speed is as regular as that of the turbine which is developing the power. It seems, however, that if single phase motors are going to be adopted, it would be best for the generator to have two phases, because, in this way, we get a larger output for the same size and price of machine; the circuits may be perfectly independent, and supply separate motors. Also, the two phase system makes the rectification or commutation of the current more easy, to use it for street railways, electro-metallurgy, etc. Again, multiphase motors have a great advantage that they have been considerably utilized already, and even in small sizes have a fairly good efficiency.

With regard to the relative merits of two and three phases, several claims that cannot be supported have been put forward in favor of the latter. First, it is claimed that the saving in the copper on the line is 25 per cent. over a one phase system, and 25 or 13 per cent. over a two phase system, according as four or three wires are used for the purpose. I investigated this matter carefully and arrived at the conclusion that this was not the case, and that the three phase system had no advantage in this respect over a two phase system with three wires. Second, it is claimed that there is a greater simplicity of wiring with three phases than with two phases; but this advantage disappears when we remember that the two phase system can be used with only three wires, although this is not a plan which I would recommend. Third, it is claimed that any pair of the three wires may be used for a distribution of lighting. This is not the case. A two phase system, where the circuits are completely independent, is much more suitable for the purpose, and maintains the lights at a more constant electric pressure. Fourth, it is claimed that there is a smoother starting and rotating effort with the three phase than with the two phase system. This was originally claimed on theoretical reasons only by Dobrowolski, but every one who has used the type of two or three phase motors made by the Œrlikon Company, by C. E. L. Brown, and by the Allgemeine Electricitäts Gesellschaft, of Berlin, and others, is convinced that this advantage, which seems probable enough, is purely theoretical; it is not confirmed by actual practice, and, moreover, when the fact is known, the theoretical reason is pretty evident.

No other claims in favor of the three phase system over the two phase have ever, to my knowledge, been advanced; and, as shown above, a very full consideration of these claims does not tell in favor of the three phase. Having considered these points, the board of directors of the Cataract Construction Company, at their meeting in May, 1893, determined to reject the three phase system, leaving the single phase and the two phase available.

I wish now to say some words on a question which has absorbed my most serious attention, especially since I have been acting for the Cataract Construction Company, and this relates to the frequency of the alternating current. In America a frequency has generally been adopted of 133 complete periods per second for lighting purposes. In Europe the usual frequencies are from 70 to 100 periods per second, but a notable exception exists in the case of Messrs. Ganz & Company, of Buda Pesth, who have adopted 42 periods per second.

With the large units which will be employed in connection with the Niagara Falls scheme, the cost of the transformers is very much diminished; and this does not become so important a matter at it does when all the transformers are of small size, under 10 horse-power, as is usual in electric lighting in America. Moreover, although with lower frequency the transformers must be increased in size, the increased cost is not in proportion to the lowering in frequency, because we can use a higher induction. Mr. Steinmetz has shown that the loss due to hysteresis varies as the induction raised to the power 1.6, and it is this loss which must be kept constant when we vary the frequency. I deduce from this law the fact that in any transformer, if the hysteresis loss is kept constant, its power of doing work varies in proportion to the frequency raised to the power 0.4 (but it is probably unwise to increase the induction so much as to saturate the iron). It follows that when we double the frequency we get out of the same transformer 132 units of work instead of 100. If the frequency were quadrupled we should get 174 units instead of 100. I have been informed by Mr. William Stanley, Jr., of Pittsfield, Mass., that without the use of theory, but simply working from his experience in manufacturing and testing transformers, he obtains almost identically the same law; and I have got independent practical testimony in the same direction from other manufacturers. It appears, then, that there can be no doubt that in lowering the frequency we are not proportionately increasing the cost; but at the same time it must be realized that the cost of transformers is to a certain extent increased by lowering the frequency. If the frequency be reduced to one half, the cost is increased about 50 per cent. The lowest price which has been quoted for large transformers is $3.52 per horse-power, at a frequency of 42 periods per second. In having the frequency the extra cost would, therefore, only be $1.76 per horse-power. It becomes, then, a matter of inquiry whether the benefits to be derived by lowering the frequency in such a proportion would compensate for the extra expenditure as indicated. I am thoroughly convinced that the gain is far in excess of this amount. I shall have occasion to discuss the superior efficiency of motors at low frequency; and in most types of motors I think it safe to say that in passing from 42 periods to 21 periods, or varying the frequency in that proportion, we have a gain of at least 3 per cent. in the efficiency of the motors. Neglecting altogether the increased value of the motors from this cause, there is 3 per cent. more power at our disposal, which, at only $10 per horse power per annum, would amount to 30 cents per annum, or, capitalized at five per cent., represents an increased value of $6 per horse power of the plant, against which we have the increased cost of transformers—only $1.76. It appears, then, pretty certain that, from a purely economical consideration of the question, a lower frequency than any which has hitherto been adopted is advantageous.

With regard to the lowest limits at which we can work, since our turbines have been designed to revolve at 250 revolutions per minute, a two-poled dynamo—if such could be satisfactorily constructed—would give a frequency of four and one-sixth periods per second, and none of the synchronizing or polyphase motors employed at different factories could run at a higher speed than 250 revolutions. I am not sure that it is desirable that any motors should run at a higher speed than this, but in the few cases where this might be desirable the use of belts would be quite natural in order to give the higher speed. With a four-poled machine we would have a choice of speeds at 500 revolutions, 250 revolutions, and any sub-multiple of these speeds; for by increasing the number of poles in the motor the speed of the motor can be reduced as much as we please. With eight poles in the generator the maximum speed is 1,000 revolutions per minute, which is as high a speed as would generally be desired in connection with the factories supplied from Niagara Falls. This frequency is 16⅔ periods per second; and after considering the three points—namely, cost of transformers, speed of synchronizing motors, and convenience in the design of the generators—I came to the conclusion that, so far as motive power was concerned, this is the frequency which would be the most favorable for use at Niagara Falls.

Besides the increased cost of transformers, there is one fact which is apt, at first sight, to impress one as almost fatal to the employment of very low frequency, but which further consideration shows to be of little moment in the case of Niagara Falls; that is, that a low frequency is not suitable for electric lighting directly. But it must be remembered that it is decidedly preferable to use a direct current for arc lamps, and, in fact, in the present position of the art in America, it would be almost a necessity. Hence the natural method of arc lighting would be to use the alternating current by means of a motor to drive the well-known arc lighting machines. In the course of the work at Niagara, the first work in connection with arc lighting which will be set up is the lighting of Buffalo. At present this is done by means of steam engines, developing about 3,000 horse-power, and driving arc lighting machines of the Brush, Thomson-Houston and Wood types. There cannot be a doubt that, financially and practically, the best way of converting this station to enable them to use the power from Niagara Falls is to put in alternating motors in the place of the steam engines; and this will be the case in most of the towns which will be supplied with power from Niagara Falls.

(To be continued.)

TELEPHONE CHAT.

Sheboygan, Wis., refused the Wisconsin Telephone Company a franchise.

Indianapolis, Ind., and Hornellsville, N. Y., are the latest additions to the great metallic telephone circuit.

The New England Telephone and Telegraph Company have put South Gouldsboro, Me., in connection with the outside world.

The Southern New England Telephone Company is improving its service in Eastern Connecticut. The company recently ordered 190 miles of wire for the metallic circuits of the Norwich division.

The long distance telephone will be completed to Cincinnati in three weeks, and by January 1, 1894, Cincinnatians can talk to Chicago, Indianapolis, Philadelphia, New York, Boston and all the great cities of the East at the rate of a cent a mile for five minutes.

The American Bell Telephone Company and the Central Union Telephone Company have filed suit in the United States Circuit Court to restrain the Indiana Wire Fence Company, of Crawfordsville, Ind., from manufacturing and selling alleged infringements on patents held by the plaintiffs. The fence company makes a small electric-speaking contrivance which the plaintiff claims operates on the same principles to which they are entitled.

The American vs. The English Telegraph System.

COL. R. C. CLOWRY ATTACKS SOME OF MR. PREECE'S STATEMENTS.

Some feeling has been aroused in telegraph circles by reason of recent publications of Mr. Preece, the chief engineer of British Telegraphs, who claimed, after a visit to this country, that the English compared favorably with their American cousins.

To learn his views upon the subject, a Chicago *Inter-Ocean* reporter called on Col. R. C. Clowry, vice-president and general superintendent of the Western Union Telegraph Company, and chairman of the committee on electricity of the World's Fair.

"Colonel Clowry, did you read the telegraphic dispatches recently published in which Mr. Preece, the chief engineer of the British Telegraphs, is quoted as saying that there was only one branch of electrical industry in which the English compared favorably with their American cousins, that being telegraphy, in which they were certainly ahead?"

"Yes, I read the article you mention."

"I suppose you also read the interview with Mr. Preece, published in the New York *Sun* last August?"

"Yes, I read that also."

"What is there to be said in reply to those statements of Mr. Preece?"

"Well, a good deal can be said in reference to the matter. In Mr. Preece's interview in the *Sun*, he states that the 'telegraph facilities in England are greater than they are here, for we go to every town and every village, irrespective of the fact that they pay or do not pay, while in the States the places that pay appear to me to be the only ones that receive the attention of the telegraph companies.' In reply to that statement I quote from the annual report of the British Postmaster-General, who says:

"'The department has ceased to require the repayment of the capital outlay for telegraph extensions made under guarantee, and the guarantee is now required to cover only the expense of working and maintenance. By act of Parliament the rural sanitary authorities are empowered to undertake guarantees for telegraph offices at places within their districts and to defray the cost out of the rates. As the result of this concession there has been a considerable extension of the telegraph system in rural districts.'

"It will be seen by this that the telegraph system of Great Britain is not extended to small towns except under a guaranty to cover the working and maintenance. The statement of the Postmaster-General is, therefore, a direct contradiction of that of Mr. Preece.

"Under the Western Union system, the telegraph extends to every railway station, great and small, in the United States, without expense to the public, and we are only too glad to extend our lines to other towns not connected with railroads, where, as in Great Britain, the expense of working and maintenance is guaranteed. Notwithstanding the statement of Mr. Preece that the telegraph in England extends to every town and village, it is a fact that there are telegraph offices established at less than one-third of the post offices.

"I notice, also, that when asked by the *Sun* reporter if he considered government telegraphs a success in England, Mr. Preece said: 'Yes, they are undoubtedly a success in England.' On the other hand, the British Chancellor of the Exchequer, in laying before the House of Commons last April the annual budget, said in his speech thereupon, 'that the operation of the British government telegraphs for the fiscal year showed a "bad revenue," and an excess of actual working expenses over receipts of £115,000 ($560,000), to say nothing of the interest on the £10,000,000 ($50,000,000) of bonds issued for their acquisition. He also said that since the purchase by the government of the telegraph lines, including the moderate interest they ought to have paid upon their cost, the loss on that transaction had been £4,500,000 (about $22,000,000), which result was founded on a miscalculation, and for anything that can be seen to the contrary it is a revenue which is going from bad to worse and not likely to improve.' According to these figures the British government has operated the telegraph system for about 22 years at a loss of about $1,000,000 a year. The telegraph is used mostly by bankers, merchants, manufacturers, brokers and speculators, so that, according to the English plan, a large majority of the people who never use the telegraph have to make up this yearly deficit of $1,000,000 in order to afford the parties first named low rates on their messages. But, while for short distances the word rates in England are lower than they are here, still, owing to the different methods in vogue in the two countries for counting the number of words in a message (in Great Britain the words in the address and signature are counted, while we do not count them), the cost to the sender on an average message is about the same. The long distance rates on the Continent, and between England and the Continent are much higher than those for similar distances in the United States.

"Regarding the statement in the *Sun* article that 'Mr. Preece's department is the

Western Union and American Bell Telephone Companies rolled up into one, and half a dozen submarine cable companies thrown in, etc., I will merely call attention to the fact that the British telegraph system comprises but about 30,000 miles of line, 190,000 miles of wire, and 8,000 offices, extending over an area of about 120,000 square miles; while the Western Union Telegraph system alone comprises about 190,000 miles of line, 750,000 miles of wire, 8,500 miles of ocean submarine cables, and 22,000 offices, extending throughout an area of more than 3,000,000 square miles, being, therefore, about quadruple the British government telegraph system, and extending over an area 24 times as great. The capital account of the cost to the British government of its telegraph system is $50,000,000. If the Western Union Telegraph Company's capital account was in proportion to its property in the same ratio it would be over $200,000,000.

"Mr. Preece, in his interview, says that: 'In England the telegraphs belong to the people; they are maintained by the people; they are supervised by the people; for every Englishman has the right to complain of any delay or anything wrong, not only through the press, but in the Houses of Parliament, and every complaint of every kind received from any member of the public receives as much attention as though it came through the Houses of Parliament.'

"Now, an examination into the conditions under which telegraphic business is transacted in the two countries will show that in the United States there is sharp competition, two competing companies having always been in the field—sometimes more; and that our business men fully appreciate the value of competition as an incentive to prompt and efficient service, knowing that if one company does not give satisfaction they can transfer their patronage to another. Again, as the telegraph service in America is essentially under the control of the people (being amenable under the law to every inhabitant of the country, should errors or unnecessary delays occur in the transmission of messages the public have redress through the courts, and can and do recover damages, and it is a crime under the law for employés of telegraph companies to divulge or make improper use of the contents of messages.

"On the other hand, where the government has a monopoly of the telegraph business, as is the case in England and on the Continent, there is no competition and no redress whatever for delay of error in the transmission of messages over and above the refunding of the actual tolls paid upon the message, which may possibly be secured after a correspondence more or less prolonged, and the governments, having direct control of the telegraphs, exercise an espionage over the contents of all messages transmitted, which would not be tolerated by the people of the United States. Now, I wish to call attention to the fact that the employés of the competing telegraph companies of the United States are, in the main, persons who have been in the business all their lives, the tenure of their positions depending upon their efficiency. But, if the telegraph business were controlled by the government, political loyalty to the party in power would be more apt to be regarded as the gauge of qualification than ability to perform the duties of the position.

"Fourteen years ago Mr. Preece first visited this country, and at that time I understood him to say that there was not an operator in Europe who read by sound, although the sound-reading system had been in vogue in this coontry for upward of 30 years. On his return to England he stated, in a paper, read before a society of which he was a member, that England was 20 years behind the United States in its telegraphic development, and for this he was severely criticised by some of the English papers. About eight years later Mr. Preece again visited this country and stated that they were making considerable progress in the direction of introducing the American, or Morse, sound reading system. He again visited the United States this year and informed me that it would be very difficult to distinguish an English from a Western Union telegraph office, they were so much alike, and that the American (Morse) or sound reading system was in general use in England. It appears, therefore, that Mr. Preece has introduced the American system in his own country, and in this he has shown great wisdom, as it is, and always has been, very much superior to the European system. If it had not been for Mr. Preece's visits to the United States, and his ability to adopt our system and improvements, I am afraid that the English would still be dragging along with the old-fashioned dial needle instruments, as they are singularly averse to what they call 'American innovations.'

"During the past Summer I have met and conversed with representative electricians from nearly all parts of the world, who came here to visit the exposition. Each of them has inspected the Western Union office and system in Chicago, and in every case has stated distinctly that the progress of telegraphy in the United States was very far in advance of what it was in Europe. Our instruments, switch boards, etc., appear to be a revelation to most of them. Then again, the United States is the only country in which telegraph lines are operated direct from dynamo current. In Europe they still adhere to the old battery system (in some cases using storage batteries), and the gentlemen who visited me were surprised to see the great advance we have made in this direction. The only European instruments which we have adopted in this country are the English Wheatstone, which we work to advantage on some of our long circuits; while in England they are gradually substituting our Morse system, including the duplex, quadruplex, etc., for their old machinery. In fact, an electric manufacturing company of Chicago is shipping telegraphic instruments to nearly all parts of Europe. It appears to me, therefore, that the United States is very much in advance of all European countries in all branches of electrical industries, the telegraph and telephone included, and, in fact, in all mechanical industries, very nearly all of the great inventions having been made by Americans."

"Have you anything to say in reference to the electrical exhibit at the World's Fair?"

"The electrical exhibit was a very fine one; but no satisfactory exhibit of electrical industries in the United States could be given within the confines of any single building. To appreciate the extent of such industries one should travel all over the country and see the thousands of cities and towns which are lighted by electricity and furnished with transportation for the people by means of electric street railways, running at a rate of speed varying from 5 to 25 miles an hour. This list which I hand you will give you some figures from which you can form an idea of the extent of the exhibits from the different countries as they appeared in the Electricity Building at the World's Fair."

The list shows the following figures:

	Square Feet.
United States occupied	141,397
Germany occupied	24,172
France occupied	20,388
Great Britain occupied	5,031
Japan occupied	1,103
Austria occupied	1,000
Italy occupied	1,000
Other countries, less than (each)	1,000

Commercial Cable Company.

The Commercial Cable Company redeems on January 15, 1894, the last of the outstanding debenture bonds, £80,000. The company has contracted for a third cable to be laid from Canso to Waterford, Ireland, to cost $2,050,000, and which will be paid for in cash now in the treasury. This cable, it is said, will have a carrying capacity 30 per cent. greater than that of any now in use.

Chicago Electrical Association.

The Chicago Electrical Association is now holding its meetings at room 913, in the Masonic Temple, where Mr. G. Monrath addressed the last gathering on "The Electrostatic Production of Ozone." On December 19 the question of the most convenient forms of wiring tables will be discussed, and young electrical engineers who may be interested in this topic will be welcome.

The Third Avenue Cable Railroad has been given permission by the New York Board of Electrical Control to lay wires for signaling in case of accidents on the road in the Empire Subway Company's ducts. This settles the controversy over the cable company's right to stretch the wires in its own conduits.

Irregularities in Alternate Current Curves.

A PAPER READ BEFORE THE MADISON MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, AUGUST, 1893, BY FREDERICK BEDELL, K. B. MILLER AND G. F. WAGNER.

Curves of a more or less sinusoidal nature are commonly plotted to represent the instantaneous values of an alternating current, and various conclusions are drawn from their forms and relative positions. For any perfectly symmetrical generator the curves for successive periods are the same, both in shape and size, but decided differences may exist between the successive portions of the curves for machines which are not symmetrical. In the larger machines this difference is not likely to exceed one or two per cent., not introducing serious error into the mean results, although occasionally a greater difference may be found. In the smaller machines, however, the instantaneous curves show marked irregularities, so that to take one period as typical is not always justifiable.

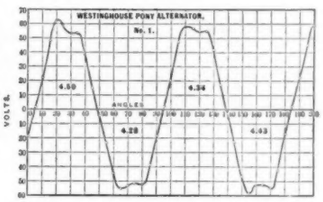
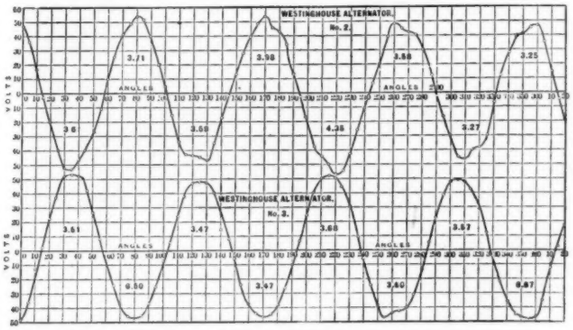


FIG. 1.—CURVE OF WESTINGHOUSE ALTERNATOR.

To investigate this point experimentally, curves 1, 2 and 3 were taken from three small eight pole Westinghouse alternators, showing the instantaneous values of the electro-motive force. The electro-motive force was measured by means of a Thomson multicellular voltmeter connected around one of two incandescent lamps connected in series across the terminals of the machine, the whole electro-motive force being readily found by a proper calibration. The instantaneous reading was obtained by means of a revolving contact-maker on the shaft which made the contact at a definite point in the revolution of the armature, as indicated by a graduated disk. The three machines from which curves 1, 2, and 3 were taken were apparently alike in all respects. An inspection of the accompanying figures shows a decided difference in the curves from different machines, and also differences between successive periods of the same machine. This is further seen by comparing the areas of consecutive loops of the curves, as marked upon them. The resistance used was non-inductive, and whether the curves represent current or electro-motive force is merely a question of scale. In any case, the ordinates of the current curve represents the instantaneous values of the current $i = \frac{dQ}{dt}$, whence the area inclosed by the curve is $\int i dt = Q$; that is, the area inclosed by the current curve is proportioned to the quantity of electricity which flows, and for a complete cycle or revolution of the armature must be zero, inasmuch as there is no continual flow one way or the other. Likewise, the ordinates of the electro-motive force curve represent the instantaneous values of the electro-motive force, $e = \frac{dN}{dt}$, and the area inclosed is proportional to the change in the number of lines of magnetization through the armature. Evidently the algebraic sum of these areas must be zero for a complete cycle, since the magnetization is the same at the beginning and end of a complete revolution of the armature. To establish this point experimentally, curves 2 and 3 were taken, each for a complete revolution of the armature. In these curves, ordinates represent electro-motive force, and abscissæ the portion of the cycle, with reference to the position of the armature at which readings were taken. The areas of these curves were obtained by a planimeter, and in arbitrary units are:

Areas, Curve No. 2.		Areas, Curve No. 3.	
Positive.	Negative.	Positive.	Negative.
3.71	3.61	3.51	3.50
3.98	3.59	3.47	3.47
3.58	4.35	3.68	3.60
3.25	3.27	3.57	3.67
14.52	14.82	14.23	14.24
Total, — .30		Total, — .01	

Although, separately, the positive and negative areas widely differ, the sum of the positive and negative areas are very nearly equal, thus experimentally establishing the conclusion reached above.



FIGS. 2 AND 3.—CURVES OF WESTINGHOUSE ALTERNATORS.

GENERAL NOTES.

The repair shops of the General Electric Company in the South have been closed by order of the executive board of the corporation. The order came from New York last week, and the Atlanta, Ga., shops were practically closed.

The annual report of the Edison Electric Light Company, of Fall River, Mass., showed the assets to be as follows: Real estate, $30,000; machinery, $89,140; cash, $9,614; stock, $15,792. Liabilities: capital, $90,000; debts, $51,531. Net decrease for year, $1,639.

Frederick Stewart has been appointed receiver of the Daft Electric Light Company, of New York, on the application of Robert L. Belknap, who obtained a judgment for $6,732 against the company, October 5. Mr. Belknap was formerly president of the company, which was merged into the United Electric Traction Company three years ago.

At the annual meeting of the Stanley Electric Manufacturing Company, held at Pittsfield, Mass., recently, treasurer Whittlesey read an encouraging financial statement. The $100,000 new stock has all been subscribed for, making the present capital $200,000. The old board of officers was elected with W. E. Tilliotson as a director, vice Charles Atwater, resigned.

Application has been made to the Supreme Court by the Schlicting and Smith Company, manufacturers of electrical apparatus, on Pearl street, Brooklyn, N. Y., for voluntary dissolution on the ground of insolvency. Judge Pratt, on the application of Isaac L. Miller, granted an order requiring all interested parties to show cause before Lawyer H. B. Hubbard, at 44 Court street, on February 26, why the corporation should not be dissolved.

The Weston Engine Company, of Painted Post, N. Y., has sued Oscar Hammerstein, of New York, for $1,250. In its complaint the Weston Engine Company alleges that in July, 1892, it entered into a written contract with Hammerstein to put into the Manhattan Opera House for $2,000 an engine to run the dynamo of that theater. It alleges that Hammerstein paid $750 on account, but declined to settle the balance and has since sold the engine to the Koster & Bial Concert Company. Hammerstein's defense is alleged breach of contract. He claims that the engine did not run "without noise or vibration," as was stipulated.

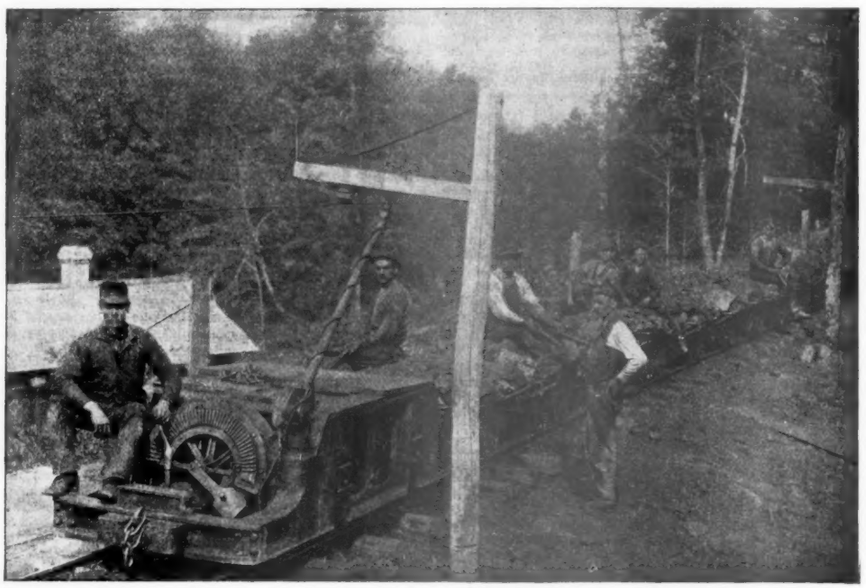
Electric Haulage in Mines.

BY RUFUS J. FOSTER.

The mines of the Brock Coal Company consist of five drift openings in a hillside about half a mile southeast of the town of Brockwayville, Jefferson County, Pa. But four of these drifts are in operation, viz., Nos. 1, 3, 4 and 5. The seam of coal worked averages about 31 inches thick. In some places it is as much as 42 inches thick, and at others it is pinched out entirely. The present production of the four drifts ranges from 300 to 400 tons per day. The inclination of the seam is very slight, being merely enough to insure natural drainage for about five inches in 100 feet. This dip is very regular. The seam has a hard sandstone top and a soft fire-clay bottom.

The outside tramway connecting the four drifts with two sets of chutes is about one mile in length. It runs along the hillside and is constructed of 25 pound T rail. The gauge of the track is 30 inches. The relay wire is insulated copper wire No. 00, of Brown & Sharpe's gauge, and the trolley wire is a bare copper wire of No. 0 B. & S. gauge. The relay wire runs from the power house across the tracks to a point on the hillside above the tracks, and thence to No. 5 drift. The trolley wire runs along the upper side and close to the track. The natural conditions existing along the side hill are very favorable, and the road was cheaply and easily constructed. All material for embankment and fills being taken from the side cut in the hill.

The grade between Drifts Nos. 2 and 3 is 1.61 per cent. in favor of the load, and the distance is 715 feet. Between Drifts Nos. 3 and 4 the grade is 2.37 per cent. in favor of the load, and the distance is 758 feet. Between Drifts Nos. 4 and 5 the grade is 3.63 per cent. in favor of the load, and the distance is 672 feet. It will thus be seen that aside from the heavy grades against the empty trips, and especially one of 4.67 per cent., the problem of outside haulage was not a very difficult one. This same remark will also apply to the inside haulage, as far as grades and curves are concerned.



ELECTRIC MINE LOCOMOTIVE ON LOADED TRIP AT BROCK MINES.

As the haulage roads are now constructed, comparatively little of the fire-clay is taken up, or in other words, but little more than half as much as when mules were used. The rails used inside are 20 lb. T rails, and the trolley wire is suspended from the roof, though in most instances it is over the ditch instead of being on the high side. The insulated hanger employed differs from the hanger used in earlier plants constructed by the General Electric Company, in that the wire is fastened to it by screws instead of by soldering, thus making changes and repairs easier and less expensive. These hangers are fastened to the roof by first drilling two holes into the top. Ordinary bolts with hexagonal heads are placed in the holes with the screw end down. They are wedged tightly in place by two semi-circular wedges, one of which is inserted with the thick end up. The other is then driven up on the opposite side, point up. This fastens the bolts securely in place with the screw ends projecting. Then a piece of four inch by three inch timber, with holes bored through it just large enough to accommodate the bolts, is placed against the top. Nuts are then screwed tightly on the ends of the bolts that extend through the block, and the hanger is screwed into the wood.

The inside grades are very regular and are about five inches in 100 feet in favor of the load. There are no extraordinarily sharp curves, if the roads are considered as mine roads, but as usual in mines they are all curves that would be considered of very small radius on the surface.

Two locomotives are used, each of the same type and capacity. The illustration shows one locomotive with a loaded trip. These locomotives, designed and built by the General Electric Company, are known as T. M. M., the locomotives of 1,500 lbs. draw-bar pull each. They are each of the following dimensions: 32 inches high, 48 inches wide and 9 feet 6 inches long. The wheels are 30 inches, and the axles 3⅜ inches in diameter. The wheel base, which is rigid, is 42 inches. Each locomotive weighs about 9,500 lbs., and has two motors of the new iron-clad street railway type equipped with four-pole Gramme-ring toothed armatures. The armatures are series connected so as to use only two brushes each, and these are on the upper side of the commutator and in an easily accessible position. The armatures are connected with the axles by machine-cut single reduction gears running in gear cases filled with oil. The frames are of cast-steel and of such shape as to thoroughly protect the spools and armatures, which are thoroughly water-proofed. The trolley arms are supplied with universal joints so that they accommodate themselves to any position required by the location of the trolley wire.

Power is furnished the locomotives from a Thomson-Houston D-40 220 volt generator run by an old style McEwen engine of about 80 horse-power.

Dynamometer tests made on one of the locomotives showed a steady draw-bar pull of 2,700 lbs., or nearly 100 per cent. overload. Whether this pull could be depended upon for any great length of time is doubtful, as it naturally pulled the speed of the machine down very appreciably. However, it showed that the 1,500 lbs. draw-bar pull can be largely increased with safety. As the engine is of much greater horse-power than is actually required, the officials of the company are talking of coupling to it another 40 kilowatts dynamo (which they have on hand), so as to gain more power to be utalized in locomotives. The speed of the locomotive is eight miles per hour.

The mine cars used are of the ordinary type used in bituminous coal mines working small seams. They have plain 11-inch wheels running on 1½ inch axles. The wheel base is 20 inches, and the capacity of each car is about 1,650 lbs. The crew employed with each locomotive consists of a motorman at $2 per day and a boy spragger at $1.25 per day.

Mr. Burr E. Cartwright, president of the Brock Coal Company, in testifying to the success of this haulage plant, says:

"In this mine the hauling of the coal from the point of mining to the tipple was for a number of years done by mules; but within the last year we have changed the motive power by substituting electric motors, or electric locomotives to haul our cars. The effect of the change from mules to electric power is a very substantial reduction in the price of hauling coal per ton, and to show this, I give here the figures showing the cost of producing coal under the two systems. During the period of eight months from January to September, 1892, the total cost of producing the coal, as charged up on our books, eliminating certain regular fixed charges, was $36,361.52; the number of tons produced in that period was 43,454, showing a cost of production per ton of $0.83678, this being before the introduction of electric haulage, except in a small experimental way.

"In the two months of March and April, 1893, after the electric traction system was fully installed and in operation, the figures appear as follows:

"Total cost of producing coal, less regular fixed charges, as stated in regard to the first period, $11,495.94. The number of tons produced was 15,415.29, showing a cost per ton of $0.74576.

"Comparing this cost per ton with the previous figures of the first period, shows a reduction in cost in this period of $0.09102 per ton.

"I regard the operation of the electrical apparatus as very satisfactory in every respect, and I intend to introduce it wherever opportunity occurs in our mining interests."

This testimony of Mr. Cartwright's was made in June last, and is corroborated by the statements of Mr. Robert Dick, superintendent of the mine, made during the past month. The figures given do not calculate in the cost of mule haulage, the expense of keeping the mules when the mine is idle. The cost of the electric plant at such times is nothing.

On Nov. 28, Lewis S. Burchard was appointed temporary receiver for the Brush-Swan Electric Light Company, of New England, in sequestration proceedings brought by the Swan Lamp Manufacturing Company. The former company was incorporated several years ago with a capital stock of $2,000,000.

Corporation Counsel Clark has decided that the New York Board of Electrical Control is subject to the jurisdiction of the Municipal Civil Service Board.

A Comparative Report of Massachusetts Railways.

In glancing through the annual reports of some of the Massachusetts railway companies some interesting facts are brought to light and none more so than a comparison of the figures of steam and street railways. The reports are made up to June 30. The Boston & Maine, Boston & Albany, Old Colony, New York & New England and Fitchburg railroads carried 91,077,130 passengers. The West End street railway carried 145,068,370 passengers, this including free transfers.

On the five steam railroads 362 fatal injuries are reported and on the West End 20. Of this number, 45 of those killed on the steam railroads were passengers and on the West End one. Of those killed on the steam roads about 300 were employés.

On the steam railroads 1,470 were injured, and on the West End, 310. On the steam railroads one person was killed or injured to every 23,225 miles run. On the West End, one person was killed or injured to every 56,575 miles run. In this connection it should be noted that the cars of the West End railway run upon the thoroughfares.

It is a significant fact that out of 145,068,370 passengers carried by the West End road but one was killed, and there was but one injured to every 858,392 carried. One the steam railroads there was one fatal injury in every 3,794,840 carried, and one injured in every 427,592 carried. The steam roads ran 18,864,235 passenger miles, and the West End, 18,669,809 passenger miles.—*Exchange.*

Erie Telephone Extensions.

The Erie Telephone and Telegraph Company has negotiated an issue of $1,000,000 six per cent. 15 year gold collateral trust bonds. The bonds are issued to make further extension of the company's lines, to purchase land and erect permanent exchange buildings thereon, to extend the underground system in Cleveland, Minneapolis and St. Paul, and to supply a great demand for the long distauce telephone and metallic circuit service, both local and ex-territorial. The American Bell Telephone Company, which is a third owner in the plants controlled by the Erie Company, has subscribed its proportionate share of the funds required to carry forward the new construction. Stocks of the three sub-companies, amounting to over $2,000,000 estimated market valuation, will be deposited with the Old Colony Trust Company, of Boston, which acts as trustee under the identure, as additional security for the holders of these bonds.

Another Attachment by Telephone.

The sheriff has received an attachment for $3,108 against Mary D. Esterheld, manufacturer of cotton goods, at Philadelphia, in favor of Arthur W. Andrews, of New York, on assigned claims of John J. McClosky and Hugh A. O'Neill, both of Philadelphia, for cotton goods sold to her. The amounts of the two claims were communicated to the attorney from Philadelphia to New York over the telephone. The sheriff levied on her equity in consigned goods in the hands of a commission merchant.

In a recent similar case, where a Boston man obtained an attachment in New York by telephone, Judge Barrett vacated it on the ground that the New York party had no means of knowing that it was the Boston party, with whom he did not appear to have been acquainted.

The Telephone Girl Was There.

She is the brown-eyed girl who works in the telephone exchange, and he is the young man who is sometimes more energetic than courteous.

"Hello, central," he called the other day, "this is the second time I have called you. Have you been asleep?"

"Yes," she answered sweetly, "I have, and I had such a strange dream. I thought I heard a voice from the infernal regions and awoke just in time to hear you calling. What number?"—*Washington Evening Star.*

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week.

New Electric Railways.

ST. JOSEPH, MICH.—The St. Joseph city council has granted a franchise to the St. Joseph and Lake Shore Railway Company and the St. Joseph Electric Light and Power Company to construct an electric railway from the center of the city to the southern limits, and to furnish electric power and light to St. Joseph. The company is composed of Chicago capitalists, and the railway and light plant are to be in operation by August 1, 1894. The company gives the city a bond for $10,000 for the performance of the work.

GLOUCESTER, MASS.—It is reported that the street railway company is to put in a 250 horse-power engine and a generator of corresponding size in its power house on Washington street to furnish motive power.

BRAINTREE, MASS.—The Braintree Street Railway Company has petitioned the Legislature for authority to purchase the franchise and property of the Randolph Street Railway Company, and to increase its stock.

COTTAGE CITY, MASS.—The petition of the Cottage City Electric Light and Power Company has been granted by the selectmen of Cottage City. The plant, which will cost $60,000, will be located near Eastville, so as to supply light and power to the village of Vineyard Haven. The grant requires furnishing of electric lights, both arc and incandescent, during the entire year.

GREAT BARRINGTON, MASS.—The Berkshire Light, Heat and Power Company, of Monterey will shortly be incorporated, the stock having been all subscribed for.

DENVER, COL.—Charles F. Lacombe, Allen G. Bentley and George A. Goddard have incorporated the La Junta Electric Company, capitalized at $25,000, to operate in Otero county.

BALTIMORE, MD.—Articles of incorporation have been granted the Chesapeake and Ohio Transportation Company, organized for the operation of canal boats by electricity. The amount of the capital stock of the Maryland company is $250,000, divided into 2,500 shares of $100 each. Most of these shares are held by coal operators in western Maryland. A board of directors has been elected for the first year as follows: Charles K. Lord, H. Crawford Black and Alexander Shaw, all of Baltimore; Lloyd Lowndes, of Cumberland, and J. Clarence Lane, of Hagerstown. The term of existence of the company is 40 years. The charter is broad, but the application of electricity to the propulsion of boats on the canal is the chief object.

Electric Light and Power.

ROCKAWAY, L. I.—The Rockaway Electric Light Company, at a meeting of the board of directors held last week, elected the following officers: President, S. Myers; vice-president, George F. Porter; treasurer, John A. Seely; secretary, Mills H. Landon. It was voted to increase the plant to the extent of $14,000.

COLEBROOK, N. H.—The Colebrook Electric Light Company; capital, $12,000.

PRINCETON, IND.—The Princeton Light and Power Company; capital, $25,000.

Increase of Capital.

JANESVILLE, WIS.—The H. A. Doty Light and Power Company has increased its capital from $6,000 to $10,000.

JONESBORO, ARK.—The Jonesboro Power Company has increased its capital from $7,500 to $12,000, owned as follows: G. W. Decker, the president of the company, owns 180 shares; J. C. Hawthorne, 100 shares; W. S. Arnold, 96 shares; N. S. Lamb, 60 shares; E. F. Brown, 40 shares; S. A. Brown, Jr., 4 shares.

FIG. 1.—METROPOLITAN ELECTRIC COMPANY'S DOUBLE POLE SWITCH.

New Telephone Companies.

ERIE, PA.—The Erie Telephone Company, which has been talked about for several months, has been organized, and Attorney Rilling, the solicitor, will make application to the governor on December 22 for a charter of incorporation. The gentlemen named as incorporators are: H. C. Dunn, Louis Streuber, E. D. Carter, B. A. Smith and Ed. C. Siegel. It is said that the company will give the people of Erie cheaper telephones. Several of the gentlemen named above are interested in an electric company which was formed or is about to be formed.

MILWAUKEE, WIS.—The Northwestern Telephone and Electric Company has been incorporated with a capital of $50,000. The incorporators are A. B. Ferdinand, H. C. Dodge and H. H. Spencer.

FIG. 2.—SINGLE POLE SWITCH.

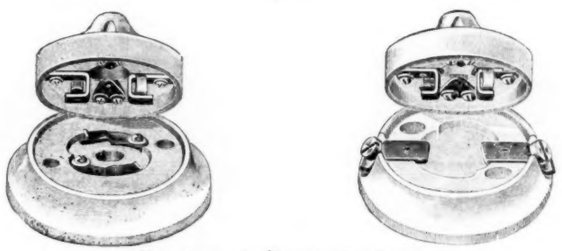
The Martinsville, Ind., Electric Light and Power Company's plant has been sold at receiver's sale for $9,700 to the Eddy Company of Windsor, Conn., and the Thomson-Houston Company, of Cincinnati, which held mortgages on the machinery.

Transmission of Power at Salt Lake City, Utah.

The Big Cottonwood Power Company has filed articles of incorporation with the county clerk at Salt Lake City, Utah. The purpose for which the corporation is formed is to use the waters of Big Cottonwood and other streams for the transmission of power for lighting, heating, cooking and for power for all kinds of machinery and for all descriptions of manufacturing; for propelling electric railway systems; for storing electricity, and for all other purposes for which electrical currents can be applied. The company also has the right to deal in real estate, bonds or stocks, do a general manufacturing business, and to construct, supply and maintain canals and pipe lines for the transfer and utilization of water for domestic and other purposes. The capital stock is fixed at $1,000,000, divided into 10,000 shares of the par value of $100 each. The incorporators and the number of shares held by each are as follows: John W. Donnellan, 250; W. H. Rowe, 54; W. H. Rowe (trustee), 2,893; Thomas Marshall, 250; George M. Cannon, 54; R. M. Jones, 3,220; Joseph W. Summerhays, 54, and Geo. M. Downey, 100; making a total of 6,875. The remaining 3,125 shares are held by the company, subject to such disposition as the board of directors may decide upon. The offices are John W. Donnellan, president; W. H. Rowe, vice-president; George M. Cannon, secretary; George M. Downey, treasurer; and R. M. Jones, general manager.

The assets of the company as listed in the articles consists of "The Stairs" water power in Big Cottonwood Canon, 14 miles from the center of distribution in Salt Lake City, which property will produce 2,500 horse power during the lowest flow, and above 3,000 horse-power during eight months of the year. The water will be utilized under 380 feet head and will be conducted a distance of 1,800 feet through steel pipe 54 inches in diameter. The water will be taken from a reservoir or natural basin known as "The Lodge," and is first conducted through 480 feet of tunnel which is nearly completed. There has been considerable development done on this property by its former owner, R. M. Jones, and this is the first installation to be undertaken by the company, which is also owner of all the property formerly owned by the Granite Paper Mills Company, consisting of 1,100 horse-power which has been in use for years, until recently when the mills were destroyed by fire, and it is now the purpose of the company to utilize this power by electrical application, and transmit to the city, a distance of 11 miles, uniting the circuits from this station and from "The Stairs," and conducting to the city over the same pole line construction. The company owns a large amount of valuable lands and improved property near the mouth of the Canon, also the water power known as "Mill B" located still further up the Canon, and 17 miles from the city. It is said that the water rights controlled by this company comprise all of the available water power within 35 miles of Salt Lake City.

The franchises for the distribution of electrical energy through all the streets in Salt Lake City and through the county to reach the city recently granted to R. M. Jones, and the city franchise for electric railway in the city and over county roads to reach Cottonwood Canon, recently granted to W. H. Rowe, R. M. Jones and others are now the property of the company. The company will continue the development of the water power during the Winter, and intends having all materials for the completion of the construction delivered and ready for use early in the Spring, both for the transmission of power and for the electric railway. The electrical and mechanical construction will be done under the direction of R. M. Jones, of Salt Lake City, who will also decide regarding apparatus, phase and voltage, and it is intended to complete both systems within 10 months.



FIGS. 3 AND 4.—CEILING CUT-OUTS.

The Metropolitan Electric Company's Factory and Specialties.

The Metropolitan Electric Company, offices 522 and 523 Monadnock Building, Chicago, have secured the entire output of H. T. Paiste's factory, and hereafter will market exclusively these specialties.

A visit made to the factory enabled an ELECTRICAL REVIEW representative to see these various articles manufactured step by step, until completed. First in importance was the making of eccentric switches. These switches are the result of years of earnest thought and experience on the part of Mr. Paiste, the pioneer switch maker. An important feature in the switch, as shown in the cut, is that all the brass parts are fixed firmly to the porcelain, without the use of screws. In porcelain there is "no cushion," hence screws will sooner or later jar out. The movement is of the eccentric order, thus insuring a positive mechanical action. The electrical contact is made by solder contacts. A test was made on a five ampere switch. This switch, it was said, had been run for four days, making thirty breaks in a minute, and made, all told, about 70,000 half revolutions—more than a switch would be used in 50 years. It was carrying a load of 25 amperes at that time, and did it without heating the contact parts. The breaking capacity will easily break 500 volts. These switches are made single and double pole, also three-way.

FIG. 5.—CLUTCH FOR T-H. ARC LAMPS.

In the cut-out department is made in large quanties the Paiste ceiling cut-out (Schaffer style) for open and concealed work. The attached cuts will readily demonstrate the simplicity and beauty of their design. Those of our readers who visited the Electricity Building at the World's Fair will remember the very neat and artistic design made exclusively by these cut-outs in Mr. Paiste's exhibit. Main and branch cut-outs of the S-M. and Edison style are also made in large quantities. A new covered branch and main has just been manufactured that will be much appreciated by the electrical trade. A covered horseshoe cut-out is in process of manufacture and will be ready to deliver in a short time.

In the stamping department is made from flat steel metal a clutch for T-H. arc lamps.

FIG. 6.—CONTACT BUSHING FOR T H ARC LAMPS.

The attached cut will illustrate the design and movement. The peculiar feature of this specialty is that it can be adjusted to a carbon rod and, therefore, is practically indestructible. German silver contacts are used throughout. Here also is made an adjustable lower contact bushing for T-H. arc lamps; the cut will easily illustrate the simplicity of the device.

Numerous screw machines were running, turning out binding posts and various other articles. Another department just being organized is the making of switch boards, etc. Here men were busy making a complete set of switch and cut-out boards for the Ryerson library.

KINDRED INTERESTS

Berlin Iron Bridge Company.—The roof for the new purifier house of the Northern Liberties Gas Company is now being put in place by the builders, the Berlin Iron Bridge Company, of East Berlin, Conn.

The Lehigh Valley Creosoting Company has removed its Jersey City, N. J., office to rooms 136 and 137 Washington Building, 1 Broadway, New York city, where all communications should be addressed.

The Clayton Air Compressor Works, 43 Dey street, New York, have republished in pamphlet form an article on "The Widening Use of Compressed Air," by Whitfield Price Pressinger, which appeared in the *Engineering Magazine* for November, 1893.

The Columbia Incandescent Lamp Company, of St. Louis, report a constantly increasing demand for their lamps. In an announcement elsewhere in this issue of the ELECTRICAL REVIEW they enumerate some of the advantages to be obtained by dealing with them.

The Metropolitan Electric Company, Chicago, are gathering together a very important line of electric railway devices, prominent among which are the Standard Paint Company's P. and B. specialties, the "Anti-Thunderbolt" oil paper, special oil glass insulators, N. I. R. feed wire, etc.

The First of the Season.—The very first calendar for 1894 received by the ELECTRICAL REVIEW is a handsome production sent out by the Direct United States Cable Company, 40 Broadway, New York. It is a pad memorandum calendar mounted on a handsomely illuminated card. Every day of '94 this warning will greet the eye of the user: "Mark your cablegrams '*Via* Direct Cable.'"

The Tobin Bronze rolled plates, with which the victorious cup-defender "Vigilant" is plated, are about 15 feet long, four feet wide and one-quarter inch thick. They are riveted to steel frames with machine made Tobin bronze rivets. The Ansonia Brass and Copper Company, manufacturers of Tobin bronze, are receiving many inquiries from yacht builders in regard to this valuable metal.

The "Paranite" Wire Company, who have established an eastern sales department at No. 220 Devonshire street, Boston, with a branch office and warehouse at No. 32 and 34 Frankfort street, New York, report a very satisfactory condition of business amongst much of our best eastern trade. Those who have tried "Paranite" wire express themselves most favorably as to its high grade insulation qualities and satisfactory handling.

The Central Electric Company, Chicago, report that their sales on anti-thunderbolt oil paper show a large and increasing demand for a product of this nature, which is absolutely reliable. This paper is a preventive for short circuits and grounds when used in winding armatures, fields and converters, and is unsurpassed for electric manufacturing and repairing. It will resist the highest voltages, also the action of oil, water and dampness, and the injurious action of chemicals and gases and it does not crack or tear when folded. The genuine oil paper is stamped "Anti-Thunderbolt."

Queen & Company.—It is a well-known fact that Queen & Company, incorporated, Philadelphia, have an excellent article in their portable testing sets, wound with platinoid wire. For several years they claim to have held the lead in resistance coils of all kinds, both for laboratory and commercial purposes, and are now bringing out a "Style B" of their "Acme" engineering set, which must surely meet with much favor. It is completely self contained, comprising bridge, rheostat, D'Arsonval galvanometer, battery and keys, all mounted in a highly finished mahogany box 8¼x5¾x5 inches, that weighs less than six pounds ready for use. The extreme portability of the apparatus, and the fact that rapid measurements can be made under conditions that do not admit of another type of galvanometer being employed, recommend the set to the careful consideration of intending buyers. Descriptive circular No. 445 will be mailed free upon request to the makers.

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